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U.S. Army Toxic and Hazardous Materials Agency

ENVIRONMENTAL SURVEY PLANS FORT SHERIDAN FORT SHERIDAN, ILLINOIS

FINAL SAMPLING AND ANALYSIS PLAN DATA ITEM A004 DAAA15-88-D-0006

prepared by

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JULY 1990

SAMPLING AND ANALYSIS PLAN
DATA ITEM A004

FORT SHERIDAN
ENVIRONMENTAL SURVEY PLANS

CONTRACT NO. DAAA15-88-D-0006
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Prepared for:

U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY
ABERDEEN PROVING GROUND, MARYLAND

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SAMPLING AND ANALYSIS PLAN
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1.0 PROJECT DESCRIPTION

1.1 BACKGROUND INFORMATION

The U.S. Army Installation Restoration Program (IRP) was designed to identify and control or abate contaminant migration resulting from past operations at Army installations. The IRP is the Army's response authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. As delegated by Executive Order 12580, the Army is responsible for determining response actions, consistent with the National Contingency Plan (NCP) (40 CFR Part 300), necessary for the abatement of contamination resulting from releases of hazardous substances.

The Assistant Chief of Engineers was designated as the responsible proponent for the Department of the Army Environmental Program. The U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), as a U.S. Army Corps of Engineers (USACE) field operating agency, is responsible for the planning, implementation, and direction of the Department of the Army Environmental Program under the Assistant Chief of Engineers; the IRP is a component of this program.

Fort Sheridan was recommended to the Secretary of Defense for closure by the Commission on Base Realignment and Closure. To support Department of the Army decisions regarding preparation of the property for release, USATHAMA is responsible for implementing environmental studies and, if necessary, restoration activities before property transfer. To minimize the potential for liability, these studies will address necessary IRP elements to comply with CERCLA, SARA, the NCP, and requirements of the Illinois Environmental Protection Agency (IEPA).

Preliminary assessments of Fort Sheridan, conducted in 1982 and 1989, identified actual and potential contamination related to previous post landfilling activities; storage and handling of petroleum, oils, and lubricants (POL), as well as other motor pool wastes; polychlorinated biphenyl (PCB)-containing electrical equipment; and storage and handling of pesticides (Gross et al., 1982; and Argonne National Laboratory, 1989).

The nature and duration of these activities at Fort Sheridan justify conducting a Remedial Investigation/Feasibility Study (RI/FS) to verify and quantify the nature and extent of contamination, perform public health and environmental risk assessments, and evaluate remedial action alternatives leading to individual site response actions, if necessary.

At Fort Sheridan, the RI objectives are to acquire the data necessary to define the distribution, types, and concentrations of contaminants, and to assess current and/or future risks to public health and the environment from exposure to these contaminants. Data collected in the RI are designed to support the FS and decision documents that address mitigation of environmental contamination at individual sites. The RI will also support no-action decisions at identified potential sites with sufficient data to demonstrate a lack of significant residual contamination.

The RI/FS program will be conducted in accordance with the U.S. Environmental Protection Agency (USEPA) RI/FS Draft Guidance Manual, which addresses the SARA amendments to CERCLA and state guidelines (USEPA, 1988). As such, the RI/FS program is implemented in accordance with the Technical Plan (Data Item A005). This plan is supported by three documents: (1) the site-specific Sampling and Analysis Plan (Data Item A004); (2) the Quality Assurance Program Plan (Data Item A006); and (3) the Health and Safety Plan (Data Item A009). These plans correspond directly to the Field Sampling Plan, the Quality Assurance Project Plan (QAPP), and the Health and Safety Plan (HASP) called for in USEPA guidance.

This Sampling and Analysis Plan presents the rationale, approach, and schedule for conducting field activities at Fort Sheridan. The plan is presented in the following five sections, and is equivalent to the Field Sampling Plan described in USEPA guidelines:

Section 1.0 - Project Description
Section 2.0 - Site Management
Section 3.0 - Remedial Investigation Data Collection
Section 4.0 - Chemical Analysis Program
Section 5.0 - Site Specific Explorations

Section 1.0 presents the project overview and describes the purpose of the program. Site Management (Section 2.0) summarizes the support activities necessary for data collection and includes mobilization, site access consideration, instrumentation, documentation, field instrumentation, decontamination, and control and disposal of contaminated materials. Remedial Investigation Data Collection (Section 3.0) describes the methods employed to gather information required to meet data quality objectives. Among these methods are exploratory geophysics programs; subsurface explorations; headspace screening; monitoring well installations; permeability testing; groundwater, soil, surface water, and sediment sampling; the laboratory analytical program; and topographic survey. The Chemical Analysis Program (Section 4.0) describes the analytical methods, data management, and quality control. Finally, the Site Specific Explorations (Section 5.0) proposed for Fort Sheridan are presented for each of the identified study areas.

The Draft Enhanced Preliminary Assessment identified 14 sites with known or suspected releases of hazardous substances. Each site is addressed in this Sampling and Analysis Plan. In addition, 27 other sites or site groupings are included, based on results of aerial photograph interpretation, underground storage tank (UST) testing, and information presented in the Draft Enhanced Preliminary Assessment. This document groups those sites into the following 11 categories, based on similarities in current or past use:

- Landfills
- Coal Storage Areas
- USTs
- Vehicle and Equipment Storage (VES) Areas
- Miscellaneous Yard Areas
- Buildings
- NIKE Missile Installation

- Storm Drainage and Ravine System
- Pole-Mounted Transformers
- Asbestos-containing Materials in Buildings
- Small Arms and Coastal Artillery Impact Areas

The following 41 individual sites or site groups are addressed in this Sampling and Analysis Plan:

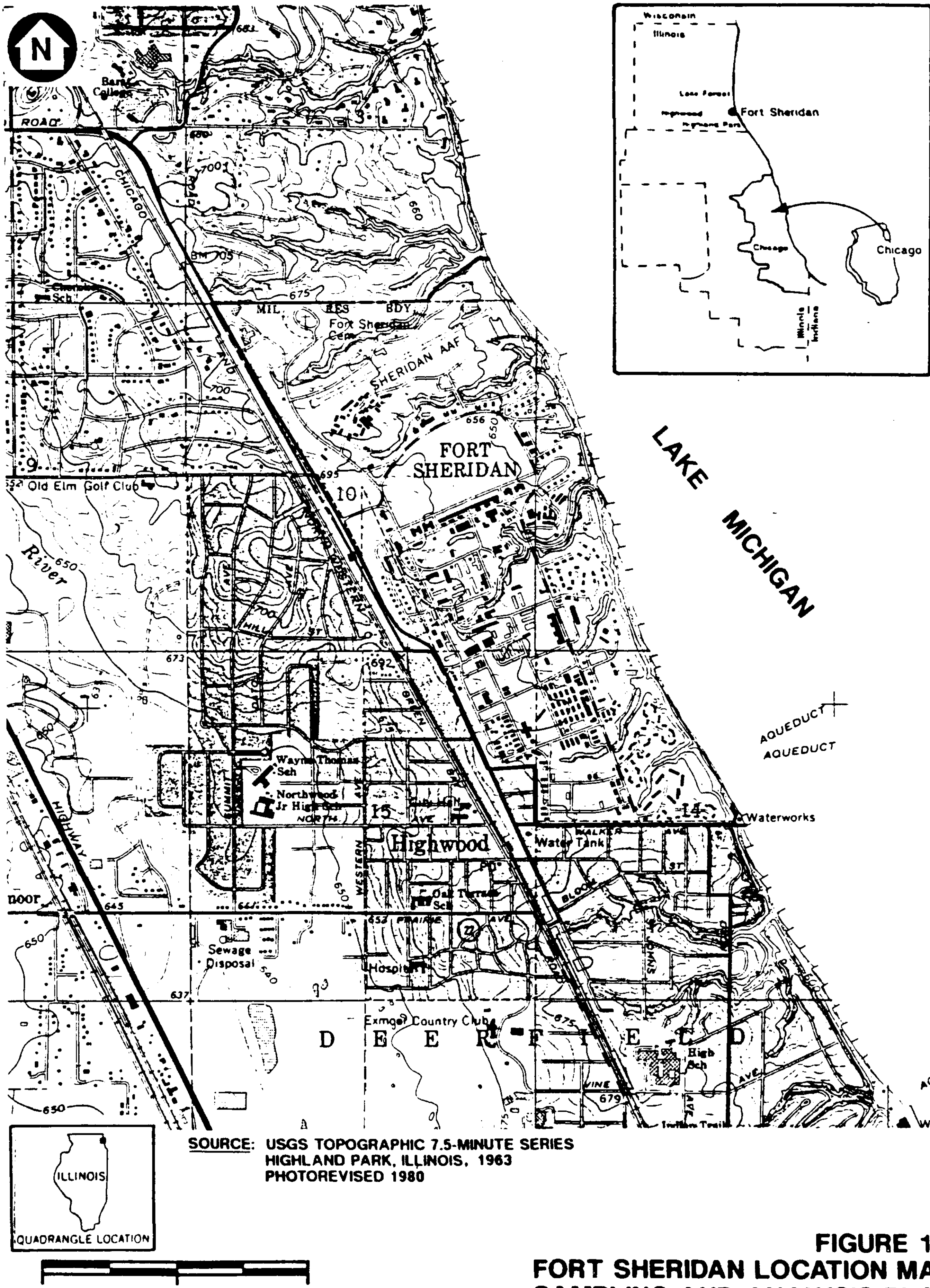
- Landfill Nos. 1 through 7
- Coal Storage Areas Nos. 1 through 4
- USTs at Buildings 115, 125, and 208
- VES Area Nos. 1, 2, 4, 5, 6, 7, and 9
- Storage Area Behind Buildings 137X, 137, and 139
- Storage Area at Building 122
- Yards at Buildings 126, 128, 216, 368, 377, and 902
- Missile Silos and Missile Fueling Point
- Buildings 43, 70, 122, 137, 142, and 361
- Storm Drainage System and Ravines
- Pole-Mounted Transformers
- Asbestos Containing Materials in Buildings
- Small Arms and Coastal Artillery Impact Areas

In addition, post-wide storm-sewer and groundwater elevation survey programs are described. The location of Fort Sheridan is shown in Figure 1-1. Individual sites are described in Section 5.0.

1.2 POPULATION AND SURROUNDING LAND USE

Most information in this section is summarized and condensed from existing documents that contain additional detail and information concerning Fort Sheridan (Gross et al., 1982; Bonds, 1987; and Argonne National Laboratory, 1989).

Fort Sheridan is located approximately 25 miles north of Chicago on the western shore of Lake Michigan. The 695-acre installation is bounded by three urban-residential communities: Lake Forest on the north, Highwood on the west, and Highland Park on the south. The three communities have a combined population of approximately 55,000. The installation currently is the operations base for Headquarters, Fourth Army, and the U.S. Recruiting Command. Its missions include command and control of reserve centers in Illinois, Iowa, Indiana, Michigan, Minnesota, Missouri, and Wisconsin; and recruiting functions for the Army. Although primarily an administrative facility, Fort Sheridan supplies maintenance and support to 74 reserve centers. On-post staff consists of approximately 1,525 military personnel and 1,650 civilians. Approximately 3,000 soldiers on active duty are stationed at the installation (Argonne National Laboratory, 1989).



SOURCE: USGS TOPOGRAPHIC 7.5-MINUTE SERIES
HIGHLAND PARK, ILLINOIS, 1963
PHOTOREVISED 1980

0 2000 4000 FEET

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FIGURE 1-1
FORT SHERIDAN LOCATION MAP
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

1.3 PHYSICAL SETTING

This subsection, which discusses the climate and physiography of Fort Sheridan, is based on information from the Draft Enhanced Preliminary Assessment (Argonne National Laboratory, 1989).

1.3.1 Climate

The climate at Fort Sheridan (north latitude 42°15') is typically continental in nature, characterized by cold wint , warm summers, and moderate amounts of rainfall. Frequent changes in temperature, humidity, wind direction, and other meteorological parameters are common due to fronts and cyclonic weather systems passing through the area, generally from west to east. January and February are the coldest months, and July and August are the warmest. Precipitation is distributed throughout the year, with the highest amounts falling in the spring and summer months, when thunderstorm activity is at its maximum. Periods of dry weather are also common in the spring and summer months.

The prevailing wind speed and direction in northeastern Illinois is from the south-southwest at about 10 miles per hour (mph) on an annual basis; however, on a monthly basis, two distinct climatological patterns are evident. From November through April, the wind is predominantly from the west at speeds of 11 to 12 mph; from June through October, the wind is predominantly from the south to southwest at speeds of 8 to 9 mph. The month of May is transitional, with prevailing winds from the northeast at approximately 11 mph.

Fort Sheridan, like other areas on or near the lakeshore, is also subject to the meteorological effects of Lake Michigan. Mean temperatures tend to be significantly higher in winter and significantly lower in summer than those of inland areas. "Lake effect" snowfall is common in winter. The contrast in temperature between the land and water also significantly affects the local wind speed and direction as compared with their synoptic values. Lake breezes are particularly common in the summer, when synoptic winds are often light and variable; these lake breezes can extend several miles inland. The transport and dispersion of air pollutants can be dramatically affected by these local variations in meteorological parameters.

1.3.2 Physiography

Fort Sheridan is located within the Lake Border Morainic System of the Central Lowlands Physiographic Province of the U.S.A. This system consists of five long, narrow, closely spaced moraines that run generally parallel to the Lake Michigan shoreline. The moraines consist of unconsolidated glacial till of Pleistocene Age, deposited during the Wisconsinan glaciation. Fort Sheridan is located along the Lake Michigan shoreline on the Highland Park Moraine, the easternmost moraine in southern Lake County, Illinois.

The topography at Fort Sheridan is relatively flat, with a gentle slope of 2 to 4 degrees to the east, terminating at a bluff line running along the lakeshore. The top of the bluff ranges from 39 to 69 feet above the Lake Michigan level. Lake Michigan elevation is approximately 581 feet above mean sea level.

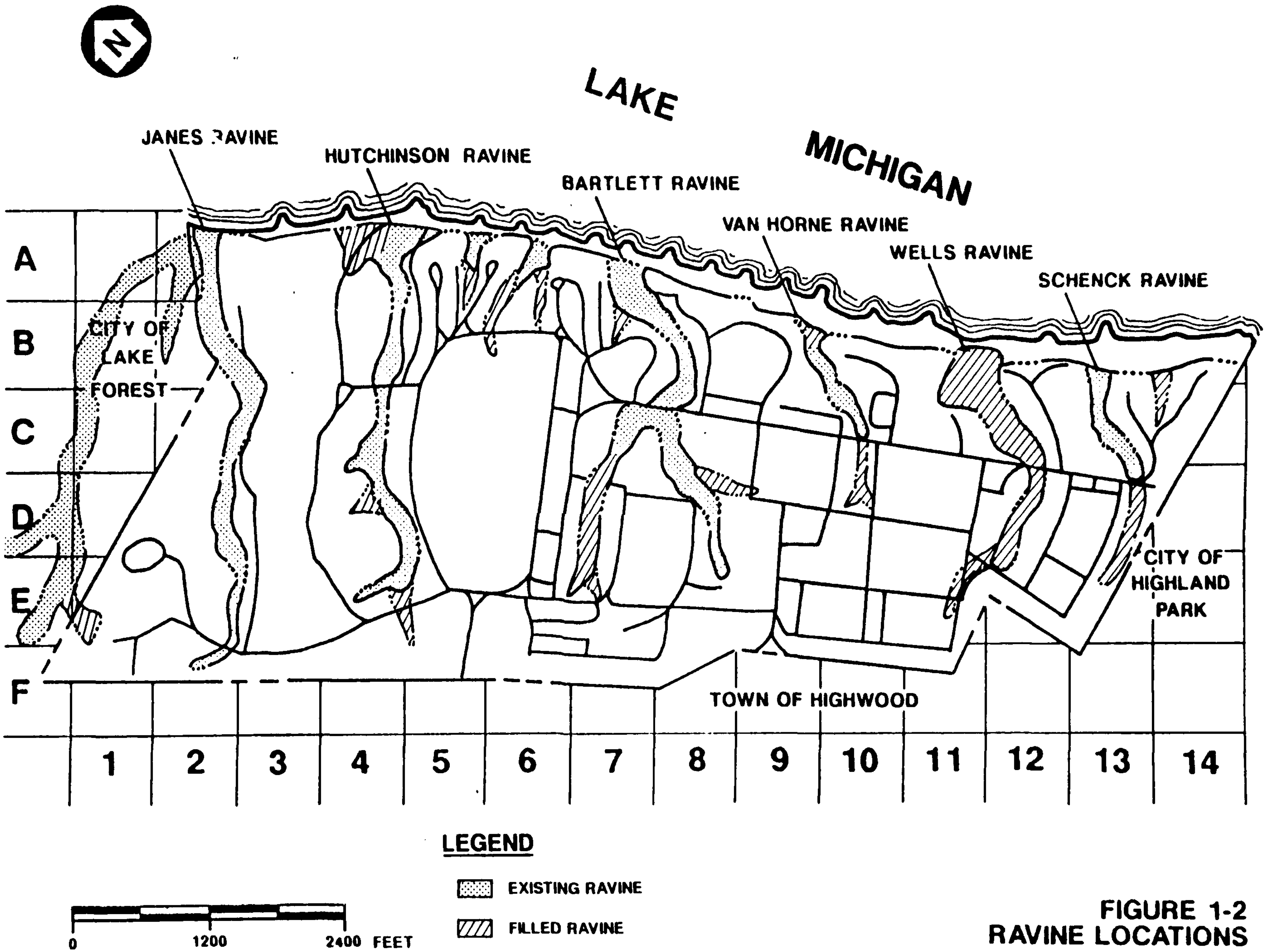
Elevations at Fort Sheridan range from approximately 650 feet above sea level at the bluff line, to up to 695 feet above sea level at the western boundary of the post. Six deep ravines traverse the property from west to east, running generally perpendicular to the shoreline (Figure 1-2). Due to the use of some of these ravines as waste disposal sites over the years, the local topography has been altered from its initial configuration. In particular, Wells Ravine and most of the northern branch of Bartlett Ravine have been completely filled in. A paved road extends along the bottom of the southern branch of Bartlett Ravine.

Beach and bluff erosion has been a continuing problem for communities along the lakeshore, particularly in recent years because of high lake levels. The Fort Sheridan bluff is also affected. To combat this problem, groins and revetments have been installed, riprap has been placed along areas of the beach and the bottom of the bluff, and in at least one area the bluff itself has been terraced. Erosion abatement efforts are continuing at Fort Sheridan, particularly near the southern end of the post.

Except for very near the lakeshore, surface water runoff within Fort Sheridan flows either into the nearest ravine or into the installation's storm sewer system. The ravines provide natural drainage pathways leading to Lake Michigan. The storm sewer system also ultimately drains into Lake Michigan, either by direct pipeline to culverts at the lakeshore or via outflows into one of the ravines. Main storm drains run along the bottom of both branches of Bartlett Ravine; the drain in the northern branch lies beneath the material used to fill the ravine, and the drain in the southern branch lies beneath the road. Numerous outflows also exist along Bartlett Ravine, and paved drainage channels lie on either side of the road. A main storm drain also underlies the Wells Ravine landfill. This drain, as well as the drain along the northern branch of Bartlett Ravine, not only service a large part of Fort Sheridan, but also receive storm drainage from the town of Highwood, immediately west of the post. There are no perennial streams on the installation. A small unnamed pond used for recreation is located near the bluff at the northern end of the installation.

1.3.2.1 Geologic Units. The Pleistocene glacial deposits at Fort Sheridan are approximately 200 feet thick. The deposits, associated with the silty clay phase of the Wadsworth Till Member of the Wedron Formation, are composed of a matrix of silt and clay in which sand, gravel, and cobbles are embedded. The upper 50-plus feet is a silty clay, while the lower units are described as a clayey silt with discontinuous fine sand and silt lenses. Sporadic boulders may also be present. The till is yellow to olive brown in the upper 1- to 15-foot oxidized zone, and gray below the water table. Permeability of the glacial deposits at Fort Sheridan is relatively low due to its high clay content. Laboratory analysis of silty clay samples had permeability values ranging from 1×10^{-8} to 1.2×10^{-7} centimeters per second (cm/sec).

The groundwater table is encountered within the till at depths up to 15 feet below ground surface at Fort Sheridan. Groundwater exists under unconfined conditions, but due to the impermeable nature of the till, may be locally perched. Limited groundwater elevation data is available from a postwide



NOTE: LOCATIONS OF FORMER RAVINES BASED ON INTERPRETATION OF EPIC AERIAL PHOTOGRAPHS AND POST MAPS FROM 1919, 1924, AND 1941.

FIGURE 1-2
RAVINE LOCATIONS
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

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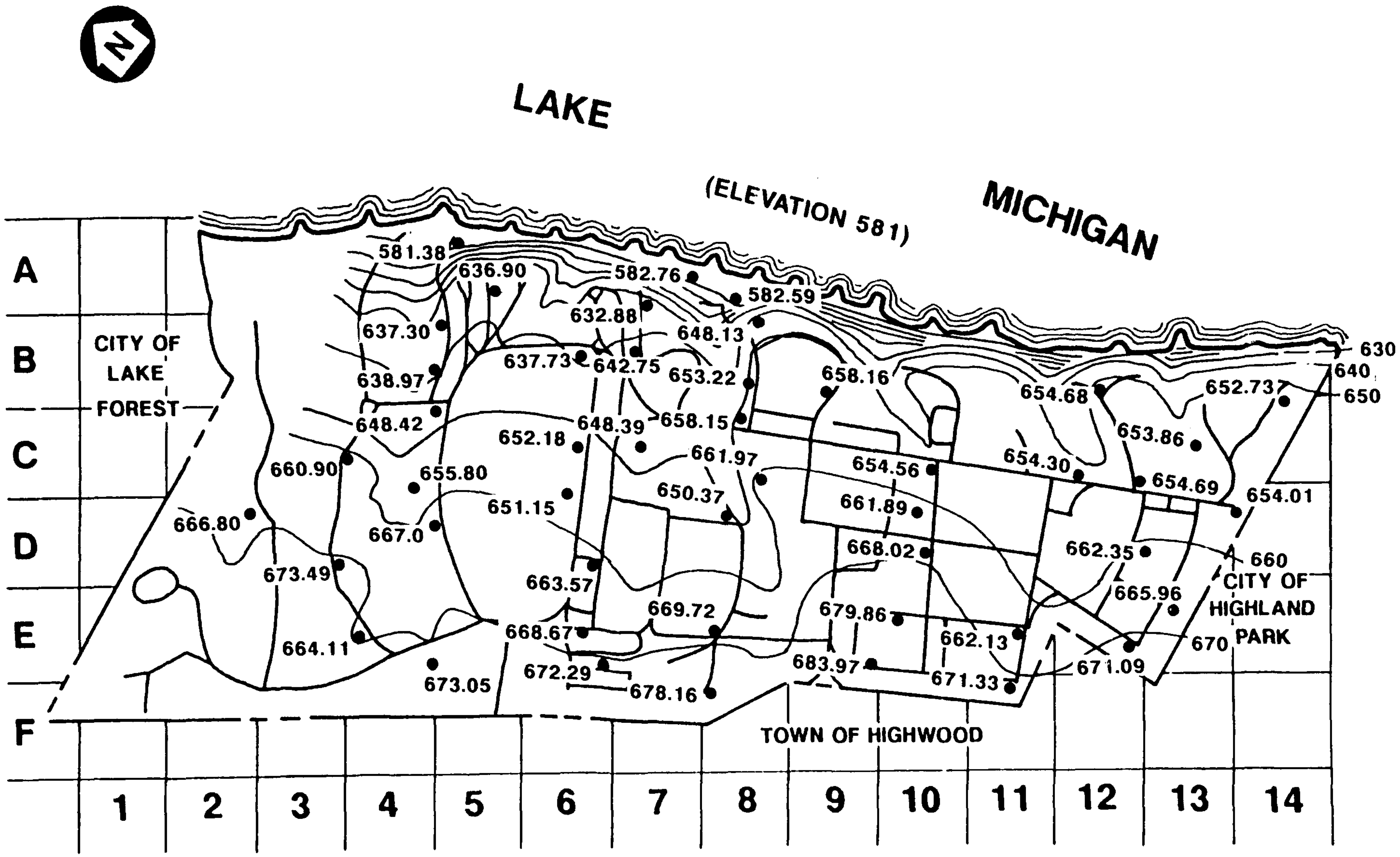
piezometer network installed in 1984 as part of a sanitary sewer investigation (Zimmer Howell Engineering, Ltd, 1984). The data indicate that regional groundwater flow is to the northeast toward Lake Michigan; however, in the vicinity of the ravines, shallow groundwater flow tends toward the ravine. Figure 1-3 shows groundwater surface contours compiled from the Inflow/Infiltration Study water levels collected on November 28, 1984. These groundwater surface contours are also shown on individual site maps. Hydraulic gradients of 0.0155 ft/ft are estimated in areas well away from ravines, while gradients of 0.145 ft/ft are estimated near the bluff and ravines.

The till is relatively impermeable. Based on laboratory permeability tests conducted for the final design of the Sanitary Landfill Closure, the upper till (7 to 8.75 ft. bgs) has permeability values of 1.2×10^{-7} centimeters per second (cm/sec) and the deeper till (83 to 85 ft. bgs) has permeability values of 1.0×10^{-8} cm/sec. Flow may be significantly greater in the upper fissured clay layers and in isolated silt, sand, and gravel lenses. Downward seepage gradients have been documented, but not quantified, in multilevel wells.

The bedrock unit immediately underlying the glacial deposits is Niagaran dolomite of Silurian Age, consisting of the Port Byron, Racine, Waukesha, Joliet, Kankakee, and Edgewood formations (Visocky et al., 1985). Together, these formations comprise the Upper Bedrock Aquigroup. The Niagaran dolomite is drab to light gray, fossiliferous, fractured (particularly in the upper 100 feet) and may contain some silt and chert. Oil, gas, and hydrogen sulfide deposits may also be present in the dolomite (Larsen, 1973). The Maquoketa Group (Ordovician Age) underlies the Silurian dolomites, and consists primarily of nonwater-bearing shales that separate the Silurian aquifer from deeper underlying water-bearing units. However, appreciable downward leakage through the Maquoketa shales to the deep bedrock aquifer system has been reported. Near Fort Sheridan, the Maquoketa shales are found at an approximate depth of 400 feet and are about 100 feet thick.

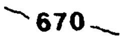
The Cambrian-Ordovician aquifer system underlies the Maquoketa shales in Lake County. This aquifer consists of a thick sequence of hydrologically connected rock formations ranging in age from middle Ordovician (i.e., Galena, Platteville, Glenwood, and St. Peter formations) to middle Cambrian (i.e., Eminence, Potosi, Franconia, Ironton, and Galesville formations). The major aquifers are the Glenwood-St. Peter (Ancell Aquifer) and Ironton-Galesville aquifers, both consisting of fine- to coarse-grained sandstones; however, the other beds, which consist of dolomite, also contribute water in some locations. The Ironton-Galesville Sandstone Aquifer is the most consistently permeable and productive formation of the Cambrian-Ordovician aquifer system in northeastern Illinois, producing approximately 50 percent of the total system yield. In southeastern Lake County, the Cambrian-Ordovician aquifer system extends in depth from approximately 500 to 1,500 feet.

The Eau Claire Formation, consisting of shales and siltstone, lies beneath the Ironton-Galesville aquifer. The upper part of the Eau Claire Formation hydrologically separates that aquifer from the deeper Elmhurst-Mt. Simon aquifer, which consists of the Elmhurst Member of the Eau Claire Formation together with the underlying Mt. Simon Formation. The Elmhurst-Mt. Simon aquifer consists of



NOTES:
1. GROUNDWATER LEVEL MEASUREMENTS COLLECTED ON NOVEMBER 28. 1984 FROM 1 1/2 INCH PIEZOMETERS INSTALLED AS PART OF INFLOW-INFILTRATION STUDY AT FORT SHERIDAN
2. ACTUAL LOCATION OF PIEZOMETER OFFSET FROM THAT SHOWN BY 4 TO 44 FEET

LEGEND



- ● PIEZOMETER LOCATION
- 670 GROUNDWATER SURFACE ELEVATION (FT. ABOVE MSL), NOV.28,1984
- 671.33 WATER ELEVATION NOV.28, 1984

FIGURE 1-3
INTERPRETATIVE GROUNDWATER SURFACE CONTOUR MAP
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

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sandstones of early Cambrian Age, and is the deepest freshwater aquifer in northeastern Illinois, extending in depth from approximately 1,700 to 3,700 feet in southeastern Lake County. Water is generally acceptable for drinking only from the uppermost few hundred feet of this aquifer, being too highly mineralized at greater depths. The Elmhurst-Mt. Simon aquifer lies unconformably on top of pre-Cambrian granitic crystalline rocks.

Fort Sheridan and all neighboring cities and towns obtain drinking water from Lake Michigan. The nearest town using groundwater as a municipal water supply is Lincolnshire, approximately 5 miles southwest of Fort Sheridan. Only one groundwater well is in use at Fort Sheridan; installed in the late 1960s, it is used only to provide water for the recreational fish pond at the northern end of the post. Argonne National Laboratory reported that this well likely penetrates the upper bedrock.

1.3.2.2 Soils. Three major and two minor surface soil series were identified at Fort Sheridan. The major series are the Morley Silt Loam, covering most of the land; the Hennepin Loam, located in parts of the northwestern, northeastern, and southeastern areas; and beach sand (also designated geologically as the Ravinia Member of the Lake Michigan Formation), located along the lakeshore. The minor soil series, which occupy small areas along the western boundary of the installation, are the Markham and Beecher silty clay loams.

1.3.2.3 Biota. Fort Sheridan has a history of shoreline retreat. A relict assemblage of rare or endangered plants, including Canadian buffalo-berry, white pine, paper birch, arbor vitae, low shadbush, common juniper, and dog violet, is found on the bluff. The bluff that lies directly below officer family housing along Boles Loop is of statewide significance because it is the largest and best of its type remaining in Illinois.

The McCormick Nature Preserve/Janes Ravine area at the northern end of the installation is of statewide significance as the finest example of a ravine system along Lake Michigan remaining in Illinois. Several species of endangered or threatened plants live in the ravine, including ground juniper, pale vetchling, black-seeded rice grass, small Solomon's seal, arbor vitae, star flower, and dog violet.

Although the wooded ravines on site could potentially harbor some endangered and threatened vertebrate species, the lack of overall habitat precludes the presence of the state's endangered and threatened amphibians, reptiles, and mammals at the fort.

Eight bird surveys were performed at Fort Sheridan in the spring of 1978 by staff of the Illinois Department of Conservation. Two endangered species (i.e., Forster's tern and common tern) and one threatened species (i.e., veery) were present as migrants, but there was no evidence they were nesting at the post. The migration route of the endangered peregrine falcon passes through the site along the lakeshore. In 1977, 66 falcons were observed migrating southward along the lakeshore. During 1987, the tower in Building 49 was used as a hacking station to reintroduce peregrine falcons to the area.

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21.

2.0 SITE MANAGEMENT

Site management activities support the data collection activities and include mobilization, site access and control, documentation, field instrumentation, decontamination, and control and disposal of contaminated materials.

2.1 MOBILIZATION

The following activities will be performed at Fort Sheridan as part of mobilization:

- command post setup, including office trailer/sample management trailer, communications (i.e., two-way radios), utility hookups, and portable toilets
- staking and utility clearance (i.e., excavation permits) of all exploration locations
- field team orientation, including security clearances for work in secure areas
- a field team health and safety meeting

2.2 SITE ACCESS AND CONTROL

Fort Sheridan is an open installation and access to most sites is unrestricted. Restricted areas of the site include the fenced parking area at the Reserve Center (Buildings 900 and 902) which is controlled by the Army Reserve, a lessee to Fort Sheridan. Additionally, access to the two boring locations on the beach near Landfill Nos. 2 and 7 may be difficult since there are no rig- accessible roads to these locations. The RI contractor will arrange access to the Reserve area through the Army Reserve, and to the beach sites through Fort Sheridan personnel.

2.3 DOCUMENTATION

Documentation and records (described in the following subsections) of all procedures performed at Fort Sheridan will be kept on-site during field operations.

2.3.1 Site Logbook

A site logbook will be kept at the field operations office trailer. Information concerning daily operations during the field program will be recorded (e.g., on-site personnel, visitors, weather, and work accomplished). Data entry into logs, forms, and notebooks will be written in black, indelible ink and initialed by the author. Entry errors in the logbook or field notebooks will be crossed

out with a single line and initialed. The Field Operations Leader (FOL) will be responsible for completing the site logbook daily.

2.3.2 Field Books

Separate field books will document the details of each activity during the field investigation. Field team personnel will be responsible for data entry in field books.

2.3.3 Field Change Logbook

A separate logbook will be maintained during the field investigation program to document deviations from the Sampling and Analysis Plan and Quality Assurance Program Plan. The FOL will be responsible for completing the logbook.

2.3.4 Field Data Sheets and Logs

Field data sheets and logs will be maintained by field team personnel, who will document items (e.g., sample location and information, field measurements, soils identification, boring information, and equipment calibration).

2.3.5 Photodocumentation

A photographic record of field activities at Fort Sheridan will be maintained. Two copies of each print will be submitted to the USATHAMA Project Manager. A photograph logbook will accompany the site camera at all times to record the date, location, time, subject matter, and photographs for each picture taken. The photograph logbook will be maintained by individual photographers.

2.3.6 Plans

A copy of the Technical Plan, the Health and Safety Plan (HASP), Sampling and Analysis Plan, Quality Assurance Program Plan (QAPP), and all referenced plans and documents, will be kept on-site. The HASP will be issued to all project personnel in the field. The HASP, QAPP, Fort Sheridan Technical Plan, USATHAMA Task Order Request, USATHAMA Geotechnical Requirements, and standard operating procedures (SOPs) will be provided to each rig or field geologist and sampling team.

2.4 FIELD INSTRUMENTATION

In addition to USATHAMA-required field equipment, The following monitoring instruments will be used during field activities at Fort Sheridan:

- photoionization detector (PID)
- explosimeter
- radiation meter
- Draeger tubes for benzene
- pH-temperature-specific conductance meter
- electronic water level meter

- metal detector
- two-way radios

Instruments will be calibrated and inspected daily before field activities begin, as suggested by the manufacturers. Calibration information will be recorded on a calibration log, which will be kept on file at the field office trailer. Malfunctioning instruments will be repaired or replaced. Monitoring equipment will be protected (as much as possible) from contamination during field exploration activities without hindering operation of the unit. Equipment maintenance will be performed according to manufacturer specifications before field use, or by cycling units out of the field. As appropriate, routine periodic maintenance may be performed as a function of field calibration.

2.5 DECONTAMINATION

To prevent cross-contamination, downhole drilling equipment, sampling equipment, and backhoe buckets will be decontaminated before use and at completion of each exploration. Decontamination of drilling and backhoe equipment (by steam-cleaning) will be conducted at each drilling or excavation location, or at a designated decontamination area.

Equipment to be decontaminated during the project may include (1) drill rig, (2) tools, (3) monitoring equipment, (4) respirators, (5) sample containers, (6) truck or trailer, and (7) laboratory equipment. Drilling equipment will be steam-cleaned prior to arrival at the Fort Sheridan site followed by on-site steam-cleaning with approved water upon site arrival and between boring/well sites. Prior to use on-site, all casings, augers, recirculation and water tanks, etc., will be devoid both inside and out of any asphaltic, bituminous, or other encrusting or coating materials, grease, grout, soil, etc. Paint applied by the equipment manufacturer need not be removed from drilling equipment. Miscellaneous tools and sampling equipment used for multiple sample collection will be steam-cleaned to assure thorough decontamination.

To the extent practical, all cleaning shall be performed in an area that is remote from and surficially cross-gradient or downgradient from any site to be sampled. All decontamination will be done by personnel in protective gear appropriate for the level of decontamination, as determined by the Health and Safety Officer. The decontamination work tasks will be split or rotated among support and work crews.

2.5.1 Water Source

The source of any water to be used in drilling, grouting, sealing, filter placement, well installation, or equipment decontamination must be approved by the Contracting Officer prior to arrival of the drilling equipment on-site. The following factors are looked for by USATHAMA in selection of a water source:

- a deep aquifer origin (ideally, greater than 200 feet below ground surface)

- well head upgradient of potential contaminant sources

- water free of survey-related contaminants by virtue of pretesting (sampling and analysis) by the contractor using a laboratory certified or in the process of being certified by USATHAMA for those contaminants

- water that is not treated or filtered

- a water source with a tap having 24-hour per day, 7-day per week access with plumbing sufficient to allow the filling of a 500-gallon tank in less than 20 minutes

- the use of only one designated tap for access

Water collected from Lake Michigan prior to any type of treatment has been selected as a potential source water. Analyses of treated water from the treatment plant on February 14, 1989 and May 26, 1989, indicate that the source may contain low levels of volatile organic compounds. The following chemicals were detected in the treated water during one or both sampling events: bromodichloromethane (1.9 μg/L), chloroform (3.2 μg/L), dichloromethane (10-210 μg/L), toluene (2.5 μg/L), total xylenes (7.9 μg/L), fluorotrichloromethane (10 μg/L), and trichlorofluoromethane (6.8 μg/L). (Department of the Army, 1989). A potential alternate source is the bedrock well located at the recreational pond, which is used to recharge the pond. Either source will be sampled and analyzed for Target Compound List (TCL) inorganics; VOCs and SVOCs by GC/MS; and pesticides/PCBs before final selection. These tests will be conducted on duplicate samples, each analyzed at a different time using separate lots. Analytical data from the well samples will be submitted as required in the USATHAMA Geotechnical Requirements on the Water Approval Request Form. Approval from the Contracting Officer will be obtained prior to the arrival of any drilling equipment on-site, as required. Three calendar weeks will be allowed from the time of receipt by USATHAMA for request evaluation and recommendation.

2.5.2 Drilling Rig and Tools

It is anticipated that the drill rigs will be contaminated during borehole activities. They will be cleaned with high-pressure water and portable high-pressure steam rinse. Solvents will not be used. Loose material will be removed by brush. The person performing this activity will usually be at Level D protection plus splash protection.

2.5.3 Sample Containers

Exterior surfaces of sample bottles will be decontaminated prior to packing for transportation to the analytical laboratory to prevent uncontainerized potentially contaminated residues from leaving the site. Sample containers will be wiped clean with a paper towel at the sample site, and then taken to the decontamination area for more thorough cleaning with USATHAMA approved or reagent water. The samples will then be transferred to a clean carrier and the sample identities will be noted and checked off against a chain-of-custody

record. The samples, now in a clean carrier, will be stored in the sample staging area prior to shipment.

2.5.4 Monitoring Equipment

Monitoring equipment will be protected as much as possible from contamination by draping, masking, or otherwise covering as much of the instruments as possible with plastic without hindering the operation of the unit. The photoionization (PI) meter, for example, can be placed in a clear plastic bag which allows reading of the scale and operation of the controls. The PI sensor can be partially wrapped, keeping the sensor tip and discharge port clear.

The contaminated equipment will be taken from the drop area and the protective coverings removed and disposed of in the appropriate containers. Any direct or obvious contamination will be brushed or wiped with a disposable paper wipe. The units can then be taken inside in a clean plastic tub, wiped off with damp disposable wipes, and dried. The units will be checked, standardized, and recharged as necessary for the next day's operation. They will then be prepared with new protective coverings.

2.5.5 Respirators

Respirators will be decontaminated daily. Taken from drop areas, the masks will be disassembled, the cartridges set aside, and the rest placed in a cleansing solution. Parts will be precoded (e.g., #1 on all parts of mask #1). After an appropriate time within the solution, the parts will be removed and rinsed with tap water. The old cartridges will be marked so as to indicate length of usage (if means to evaluate the cartridges' remaining utility are available) or will be discarded into the container for contaminated trash disposal. In the morning, the masks will be re-assembled and new cartridges installed (if appropriate). Personnel will inspect their own masks to be sure of proper readjustment of straps for proper fit.

2.5.6 Laboratory Equipment

Sample handling areas and equipment will be cleaned and wiped down daily. Disposable wipes will be used and discarded in a plastic bag. These will subsequently be taken to and placed in the disposal drum for final deposition. For final cleanup, all equipment will be disassembled and decontaminated. Any equipment that cannot be satisfactorily decontaminated will be disposed of (e.g., glassware and covers for surfaces) as previously indicated.

2.6 CONTROL AND DISPOSAL OF CONTAMINATED MATERIALS

The RI contractor will take a phased approach to managing contaminated materials:

- Phase I - Drumming and Staging

- Phase II - Sampling and Analyses

- Phase III - Development and Submittal of Disposal Plan to USATHAMA for approval

- Phase IV - Implementation of approved Disposal Plan

Phases I and II are presented in the following paragraphs. Phases III and IV will be developed by the RI contractor based on the field measurements obtained during Phase I and chemical analyses of Phase II. The ultimate disposition of the wastes will be determined based on a review of laboratory analytical results for soil and water samples of explorations contributing wastes to the drum(s) or container(s), as well as waste characterization samples obtained from waste containers.

As borings are advanced, spillage and dispersal of potentially contaminated soils and water will be minimized by using collection methods specific to the drilling technique chosen. Before mobilization, the drilling subcontractor will be required to submit an acceptable plan to minimize contact of contaminated soils and water with the environment.

Under Phase I, drill cuttings, wash and drill water, and excess soil from split-spoon samples will be inspected visually for evidence of contamination and scanned with a PID to detect the possible presence of organic vapors. Purge water that is bailed or pumped from the monitoring wells (during well development and before groundwater sampling activities) will be similarly screened. If visual evidence of contamination is observed and/or if PID levels are detected above background levels, the material will be considered contaminated, and will be collected and containerized. Soil will be containerized in DOT-approved, 55-gallon, steel drums, and groundwater will be stored in large portable containers (e.g., 6,000-gallon tanker) prior to analysis and disposal. To the extent practical, soil from separate borings will be contained in separate drums. A weather resistant label will be attached to each drum to identify its contents and point of origin. Groundwater stored in the large portable containers will not be identified separately by well designation.

Depending on the levels of personal protection used during the field investigation, disposable personal protective equipment and decontamination fluids will be generated. If contamination is suspected, these materials will be collected and containerized in DOT-approved, 55-gallon steel drums (separate from contaminated soils and water); the contents will be identified with weather-resistant labels attached to the drum exteriors.

Containerized materials will be transported to and staged at a secure temporary location predetermined by Ft. Sheridan. This location maybe either indoors or outdoors. In either case, however, a means to control entry/access will be provided. Outdoor areas will have fences with locked gates or an equivalent means of control. Indoor areas will have locked entrances or equivalent. Signs indicating that only authorized personnel are allowed to enter, and that entry can be dangerous will be posted at each entrance (e.g., Danger- Unauthorized Personnel Keep Out).

All drums will be staged on hardwood pallets. When drums are staged outdoors, a sheet of rip-stop plastic will be spread on the ground. The hardwood pallets will be placed on the plastic followed by a second sheet of rip-stop plastic. Up to four drums will then be placed on each pallet and the second plastic sheet brought up on each side of the drum and tied off. Finally, a sheet of clear plastic will be placed over the drums and secured in such a manner that precipitation does not accumulate in the second sheet of rip-stop plastic.

The RI/FS contractor will maintain a log of the containers and their contents. Drums will be individually labeled to identify contents, field measurements, and boring location (for soil cuttings).

Under Phase II, the RI contractor will sample and analyze staged drums to identify appropriate disposal options. The RI contractor will collect samples of each matrix to determine proper disposal methods. Sampling of waste materials will consist of collecting both water and soil samples from the containerized materials. One composite soil and one composite liquid (if any) sample will be collected from the staged soils cuttings drums for each boring and one composite liquid sample will be obtained from each of the containers of drill, purge, or development water. These samples will be submitted for Resource Conservation and Recovery Act (RCRA) Waste Characterization analyses (toxicity characteristics, ignitability, reactivity, and corrosivity (see Section 4.2)). Additional composite samples will be obtained at the rate of one composite sample from the soil containers for each boring and analyzed for TCL VOCs. Results of these composite analyses will provide information on which an appropriate disposal plan may be based. The Director of Engineering and Housing will be notified about containers that contain hazardous material.

Hazardous wastes are defined by RCRA as solid wastes that depending on their concentration, physical, chemical, or infectious properties have the potential to contribute to increases in mortality or to serious irreversible or incapacity reversible illness; or pose a present or potential danger to human health or to the environment when improperly treated, stored, transported, disposed, or otherwise managed. Wastes are classified as hazardous wastes if they exhibit a hazardous characteristic, if they are listed hazardous waste, or if they are a mixture of a listed hazardous waste and a nonhazardous waste.

A detailed disposal plan (Phase III) will be developed and submitted to USATHAMA within 30 days of the receipt of waste characterization and VOC analyses. The disposal plan will be based on known quantities of cuttings, water, and an understanding of waste characteristics and chemical analyses. The disposal plan will include disposal options, prequalification of disposal facilities, permitting aspects, and any additional required sampling by the disposal facilities. The RI contractor will assist Fort Sheridan in preparation of waste manifests for hazardous wastes. Fort Sheridan will be required to sign the manifest. The soils and water will be handled, transported, and disposed of according to requirements mandated by RCRA and other applicable federal, state, and local regulations. In the event that storage of containerized hazardous wastes is about to exceed the 90-day temporary storage limit, these wastes will be transported to a permitted treatment, storage, and disposal (TSD) facility.

The Great Lakes Naval Training Center Defense Reutilization and Marketing Office (GL DRMO), in support of Fort Sheridan, has a contract for the treatment and disposal of hazardous wastes from Fort Sheridan. Nonhazardous waste materials will be returned to the site where they originated, or contained and disposed of by Fort Sheridan personnel, as appropriate.

The RI contractor should be prepared to implement the disposal plan (Phase IV) upon receiving approval from USATHAMA and IEPA.

3.0 REMEDIAL INVESTIGATION DATA COLLECTION

This section consists of descriptions of the methods employed to gather information required to meet the data quality objectives outlined in the Technical Plan. Among these methods are surface geophysical measurements, shallow and deep subsurface explorations, headspace screening, monitoring well installation, in-situ permeability testing, groundwater, soil and surface water/sediment sampling, laboratory analysis, and a topographic and elevation survey. Subsection 3.2 describes the specific field investigation techniques that will be used at Fort Sheridan.

3.1 SURFACE GEOPHYSICAL MEASUREMENTS

Surface remote sensing geophysical measurements will be performed at Fort Sheridan to better define the extent of former landfills. The surface geophysical techniques will consist of vertical gradient magnetometry (MAG) and terrain conductivity (TC). These two techniques can be used effectively to determine the limits of dumping within former landfill operations. Refuse contains sufficient ferrous and non-ferrous metallic materials to be readily discernible from adjacent undisturbed areas. All measurements will be made along a 20-by-20-foot grid established by the field party with a compass and cloth tape.

The MAG survey will utilize an EDA Instruments Omni Plus Gradiometer. This instrument is a proton precession magnetometer with two sensors mounted 0.5 meters apart on a staff which is held vertically while a measurement is taken. Total magnetic field values are taken simultaneously on both sensors, and the difference between the value for the lower and upper sensor divided by the distance between them is the vertical gradient value. Vertical gradient data are more sensitive to the presence of ferrous metallic debris (buried 55-gallon drums, steel tanks) than total magnetic field data and are routinely used in applications like this.

A limited pilot study will be performed at Landfill No. 7 before full-scale testing to evaluate the effectiveness of magnetometry at the Fort Sheridan landfills. To the extent practicable, vehicles and other metal objects will be removed from the study areas before the survey.

The TC survey at Landfill Nos. 1, 2, 3, 4, 5, and 6 will utilize a Geonics EM-31DL Terrain Conductivity Meter. The EM-31DL consists of a transmitter/receiver array which can simultaneously measure both components of the magnetic field induced by the instrument when it is coupled with a digital data logger. The components which are measured are the quadrature phase and inphase values. The quadrature phase gives the terrain conductivity measurement, whereas the inphase component is significantly more sensitive to large metallic objects (e.g., buried metal drums). A digital data logger (the Omnidata Polycorder) will record all the data during this study. Because of the greater depth of Landfill No. 7, a Geonics EM-34 will be used in the TC survey at that site.

At the conclusion of each field day, the field data will be "dumped" from the Gradiometer and/or Data Logger to a field PC for initial processing and evaluation.

3.2 SUBSURFACE EXPLORATIONS

The stratigraphy and distribution of contaminants in soils at Fort Sheridan will be evaluated with test pits and soil borings at the various sites (see Section 5 for the number of and rationale for proposed explorations). Where applicable, the final placement of explorations will be determined on-site based on results of the geophysical survey. Shallow subsurface exploration program procedures are discussed in the following subsections.

3.2.1 Test Pits

Test pits will be excavated at selected sites to examine subsurface conditions and to assess the vertical and horizontal distribution of shallow soil contamination (i.e., at depths of approximately zero to 15 feet). A backhoe will be used to excavate the test pits. The backhoe bucket will be steam- cleaned between test pits and immediately before sample collection to prevent cross-contamination. Soils, stratigraphy, groundwater conditions, and evidence of contamination will be logged by the RI/FS contractor personnel. Soils will be logged using the Unified Soil Classification System (USCS). A minimum of two soil samples per test pit will be submitted for laboratory chemical analysis. Excavated soil will be backfilled into the pit to the extent backfilled into the pit to the extent possible. Remaining soil will be disposed of in the manner described in Section 2.6. Analytical soil samples will be selected based on field monitoring results (i.e., elevated PID readings) and visual indications of contamination. Standard techniques for sampling soils from test pits are described in Section 3.7. Sampling SOPs and safety procedures are also described in the Quality Assurance Program Plan and HASP (Data Items A006 and A009).

3.2.2 Soil Borings

Soil borings will be conducted in areas where exploration depths are to be below the water table (estimated to be 1 to 15 feet below ground surface) and where test pits are not feasible. If conditions are encountered where the hollow-stem auger method is not appropriate (i.e., because of large cobbles, boulders, or demolition rubble), other investigation techniques such as rotary drilling (with water or air) will be used (see Data Item A006). Equipment will be steam-cleaned between borings and handwashed between samples to minimize cross-contamination. The borings will be sampled either continuously or at 5-foot intervals using a split-spoon sampler, depending on site-specific data needs. Most borings will be completed to a depth of approximately 25 feet, 10 feet below the water table. Four borings will be completed as deep borings, approximately 70 feet in depth, to investigate deeper silt lenses. Five-foot borings will be completed at selected paved sites to conduct surface soil sampling. Soils from the boreholes will be drummed in 55-gallon DOT- approved drums or put into a roll-off container and labeled in accordance with USATHAMA

Geotechnical Requirements. The drum labels will include borehole identifications. Based on a review of analyses of soil samples from the boreholes and waste analyses, hazardous soils will be disposed of in the manner described in Section 2.6.

Samples will be collected and logged by field personnel using the USCS. At a minimum, two soil samples will be collected for laboratory chemical analysis from upgradient borings and three from downgradient borings. Analytical samples will be selected based on field monitoring results (i.e., elevated PID readings) and visual indication of contamination. Upon completion, borings which are not equipped with monitoring wells will be backfilled to the ground surface with 20:1 cement-bentonite grout. The grout used will be an organic- free, moderate pH, high solids bentonite specifically designed to seal environmental monitoring wells and boreholes. A maximum of 8 gallons of approved water per 94-pound bag of cement will be used. Standard operating procedures for soil sampling are described in Section 3.7 of this report and in the QAPP. Specifications for grout preparation are described in USATHAMA's Geotechnical Requirements. Air quality in the breathing zone will be monitored using a PID during borehole advancement. Personal protective equipment will be used as prescribed in the HASP (Data Item A009).

3.3 HEADSPACE SCREENING

Headspace from soil samples collected and placed in glass jars will be screened using a PID. Headspace will only be measured in soil samples submitted for SVOC, elements, or pesticide/PCB analysis. The screening method will consist of placing aluminum foil over the sample jar before closing the cover and, after several minutes, inserting the PID through the aluminum foil cover to measure volatile organic compounds (VOCs) in the headspace. Samples for laboratory analysis will be selected based on results of PID readings and visual evidence of contamination (e.g., stained soils).

3.4 MONITORING WELLS

Groundwater monitoring wells will be installed by Illinois state-licensed drillers to provide groundwater samples for chemical analyses, monitor groundwater elevations, and measure in situ aquifer permeability. Most of the proposed monitoring wells will be shallow, with screens that intercept the water table surface. A smaller number of monitoring wells will be installed as deep wells to (1) monitor deeper groundwater quality within the till, and (2) collect groundwater elevation data to investigate vertical gradients. Standard techniques for monitoring well installation are described in the Quality Assurance Program Plan (Data Item A006).

Well locations will be selected based on expected groundwater gradients to provide either upgradient or downgradient monitoring points. Upgradient wells will provide information to characterize the quality of groundwater entering the site, and downgradient wells will provide information to characterize the quality of water leaving the site. Comparison of upgradient and downgradient data will allow evaluation of site impacts.

Monitoring wells will be constructed of 4-inch ID, Schedule 40, flush-threaded, polyvinyl chloride (PVC) screen and riser. Screen slot size will be based on previously conducted grain-size distribution analyses for the strata encountered. All well screens will be machine-slotted and will have a solid bottom. Well screens and risers will be steam-cleaned by the drilling contractor, and well joints will be wrapped with Teflon tape before installation. The annulus or annular space around all well screens will be backfilled with a clean silica sand, compatible with the screen slot size. Space allowing, the sandpack will extend from a maximum of 3 feet below the bottom of the well screen to 5 feet above the top. If conditions permit, a 5-foot bentonite pellet seal will be installed above the sandpack in the shallow wells. If, as anticipated, the water table is shallow (less than 12 feet below ground), USATHAMA requirements for a minimum 5-foot bentonite pellet seal and 5 feet of sand above the top of the well screen cannot be implemented. In this case, approval for alternate specifications will be sought from USATHAMA. For the water table wells, grout will be tremied into place above the bentonite pellet seal, extending to the ground surface. For the deep wells, if bentonite pellets cannot be placed at the required depth, a bentonite slurry seal will be tremied into place The monitoring well screen and sandpack will be flushed and developed before sampling to remove fines and improve the hydraulic connection with natural soils.

Each of the wells will be developed no sooner than 48 hours after completion. Monitoring wells will be developed to remove sediment and establish a hydraulic connection to the aquifer by alternately pumping and surging as described in the Quality Assurance Program Plan (Data Item A006). If wells are slow to recharge, development will be accomplished by purging the well a minimum of five well volumes, plus five times the annular volume (assuming 30% porosity in the sandpack) as described in the USATHAMA geotechnical requirements. Wells will generally be developed for at least an hour, or until the field geologist determines the water is clear and free of silts and the pH has stabilized. For those wells where the borehole was made or enlarged with the use of drilling fluid (mud and/or water) a minimum of five times the measured amount of total fluids lost while drilling plus five times the well and annular volume will be removed. Development water will be disposed of in the manner described in Section 2.6.

Monitoring wells will have either flush-mounted or aboveground protective casings installed and sealed into the ground over the well riser. Protective steel casings will be equipped with locking covers. Wells will be equipped with keyed-alike locks across the entire post. A cement seal and gravel base will be placed at the ground surface around each protective casing to secure the casing, prevent surface runoff from entering the borehole, and direct runoff away from the casing. Where required, pickets will be placed around the well to protect it from damage. The aboveground portions of both the well riser and protective casing will be vented. The protective casing will have a weep hole near ground level to allow water to drain from inside the casing. Wells will be permanently and properly identified in the field. Flush-mounted monitoring wells will be protected from flooding by watertight caps and a sloped concrete pad to divert water. Figure 3-1 shows a diagram of a water table monitoring well.

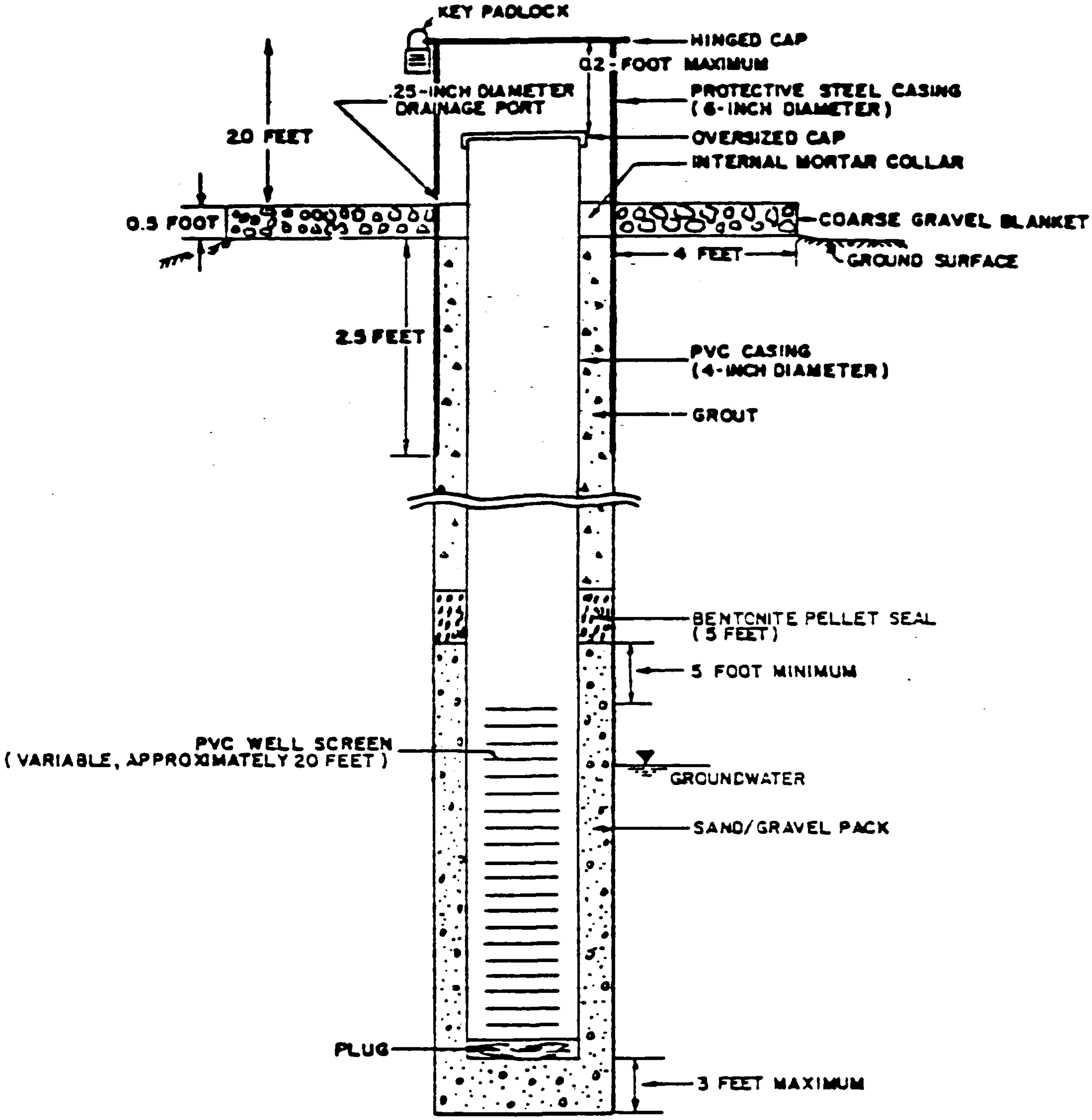

FIGURE 3-1
WATER TABLE MONITORING WELL DIAGRAM
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

6075-03

3.5 PERMEABILITY TESTING

No sooner than two weeks after well development, permeability testing will be conducted in selected wells located in areas deemed representative of the formation. Rising- or constant-head permeability tests will be performed, depending on the hydraulic conductivity of the medium being tested. Only rising-head tests will be performed on wells straddling the water table. Using a pressure transducer and data logger, or a water level meter, water level changes will be measured as a function of time as the water level returns to its static level. A minimum of one monitoring well will be tested per site. A minimum of two tests per well will be conducted to assess variations associated with each test, evaluate inertial effects associated with each well, and provide quality control. To the extent practicable, to minimize disposal of potentially contaminated water and minimize health and safety risks, the wells will be selected from upgradient areas relative to their respective sites, or in areas anticipated to contain low levels of contamination. Test data will be evaluated using Hvorslev (1951) or Bouwer and Rice (1976) analysis methods. Approximately 14 wells will be tested.

3.6 GROUNDWATER SAMPLING

One round of groundwater samples will be collected no sooner than two weeks after well development from each of the shallow and deep wells installed as part of the RI. A total of 34 water table wells and 4 deep wells will be sampled. Groundwater samples will be obtained from monitoring wells using methods specific to the analysis to be performed. Before sample collection, water level and ambient air quality data (measured with a PID) will be obtained and recorded on field data sheets, as described in the Quality Assurance Program Plan (Data Item A006). Sample bottles will be rinsed three times with well water before being filled. Field instrumentation equipment will be calibrated daily and throughout the sampling day, between sites. The calibration data will be recorded on daily field calibration logs. Wells will be purged (i.e., removal of five well and annulus volumes) before sampling using a pump, bailer, or other suitable equipment. Field parameters, including temperature, pH, and specific conductance, will be measured and recorded on field data sheets at the time of sampling. Purged water will be collected and disposed of in the manner described in Section 2.6.

Any additional groundwater sampling needs will be determined after review of analytical results. A revised SAP will reflect recommendations for any additional sampling.

Inorganic samples will be collected using a submersible pump and filtered in the field through in-line 0.45-micron membrane filters. Water samples to be analyzed for VOCs and SVOCs will be collected using a Teflon or stainless-steel bailer with a ball check valve lowered to the midpoint of the screened interval and pulled back to the surface. Water from the bailer will be poured directly into the sample bottles. Specific methodologies are described in the Quality Assurance Program Plan (Data Item A006).

3.7 SOIL SAMPLING

3.7.1 Subsurface Soil Samples

Soil samples will be collected for geologic interpretation and laboratory analysis. Sample selection for chemical analysis will be based on monitoring during drilling activities or as specified in the site-specific exploration program. Soil samples will be obtained from soil borings using split-spoon samplers that are steam cleaned between sites and hand-washed between samples. Samples collected in split-spoons will be screened with a PID immediately following collection. Based on results of the field screening, soil samples will be submitted for laboratory analysis. Soil samples will be logged by RI/FS contractor personnel using the USCS. Generally, one boring per site will be sampled continuously to characterize subsurface geology. The remaining boreholes will be sampled at a maximum of 5-foot intervals or more frequently at stratigraphic changes. Of these samples, two soil samples from the upgradient boring(s) and an average of three samples from each downgradient boring will be submitted for laboratory chemical analysis. Samples will not be composited for laboratory analysis.

3.7.2 Surface Soil Samples

If conditions permit, hand augers (for sample depths from zero to 5 feet) and bulb planters (for sample depths from zero to 6 inches) will be used to collect shallow soil samples for laboratory analysis. If used, hand- or power-augers will be decontaminated between each exploration. Bulb planters will be decontaminated before sampling and discarded after use. Due to the very hard nature of the till, collection of surface soil samples (zero to 5 feet) is anticipated to require test pitting or soil boring techniques. The soil samples will be logged by field personnel using the USCS. Standard techniques for sampling shallow soils are described in the Quality Assurance Program Plan (Data Item A006).

If surface soil sampling cannot be accomplished with hand augers or bulb planters, samples will be collected from shallow test pits or borings. Soil samples collected from test pits will be obtained from the center of the backhoe bucket. The sampler will direct the backhoe operator to remove material from the selected depth or location within the test pit. The bucket will be brought to the surface and moved away from the test pit. Discrete samples will be selected from the center of the bucket based on visual evidence of contamination. To reduce the potential for volatilization of the sample, the sampler will scrape off the first few inches of soil with a stainless steel sampling spoon, and then collect a sample from beneath that area as quickly as possible using a clean stainless steel sampling spoon. Site personnel will not enter excavations that are not adequately shored or sloped. If borings are used, surface soil samples will be collected with the split- spoon sampler from the interval immediately below the pavement or ground surface. Composite samples will not be collected. The backhoe bucket will be steam cleaned between sites and immediately before sample collection to minimize cross-contamination.

3.8 STORM SEWER AND SEDIMENT SAMPLING

Stormwater and sediment samples will be collected at selected sites within the post-wide storm sewer system to assess potential contaminant migration by surface runoff or sediment transport within the storm sewer system. Sampling will begin downstream and work progressively upstream to avoid disturbing sediments that could contaminate subsequent samples. Field information will be recorded on surface water and sediment sample data sheets. Based on observed flows and depths of water at the designated sampling locations, water samples will be collected at approximate mid-depth levels in the water column. At water depths of 2 to 6 feet, the samples will be collected using a discrete stainless-steel water sampler. At shallow locations, samples will be collected by direct immersion of sample bottles. Care will be taken to avoid stirring up sediments that would contaminate the water sample. Where both water and sediment sampling is planned, water samples will be collected before sediment samples at each site. Sediment samples will be collected using either a gravity corer or stainless-steel split-spoon sampler, depending on the bottom type and overlying water depth. Sampling methods are described in detail in the Quality Assurance Program Plan (Data Item A006).

3.9 LANDFILL GAS AND AIR MONITORING

Potential sources of air emissions from Landfill No. 7 include six passive gas vents and numerous fissures in the landfill cap surface. As the landfill was used for many years to dispose of all types of waste generated on-site, it is anticipated that the emissions from Landfill No. 7 will be comprised of typical landfill gases (i.e., methane, carbon dioxide, hydrogen sulfide, and volatile organic compounds). Of these, the volatile organic compounds (VOCs) generally comprise a small fraction of landfill gases; however, from a toxicity basis, the VOCs are generally the compounds of concern in any landfill gas air monitoring program. VOCs in landfill gas are thought to originate both from former dumping of solvents and from the bacterial decomposition of organic material. Vinyl chloride and benzene are generally major components of landfill gas VOCs. Both are extremely toxic air pollutants, and known or suspected human carcinogens.

The objective of the air monitoring program for this landfill is to determine if harmful levels of toxic air pollutants are being emitted from the site in its present state, and to determine the impact of drilling activities on the site air quality. This will include measurement of landfill vent emissions, area monitoring both on-site and in the residential zone located immediately adjacent to the landfill site, and an evaluation in a nearby residential area via computer dispersion modeling.

The following landfill gas air monitoring program has been developed in accordance with the guidelines and procedures outlined in the Air/Superfund National Technical Guidance Study Series documents (EPA 450/1-89-001, 002, 003, and 004). This a a four volume series which provides guidance on the development of air pathways analyses. Volumes used in the preparation of this air monitoring plan are listed as follows:

- Volume I - Application of Air Pathway Analyses in Superfund Activities

- Volume II - Estimation of Baseline Air Emissions at Superfund Sites

- Volume III - Estimation of Air Emissions from Cleanup Activities at Superfund Sites

- Volume IV - Procedures for Dispersion Modeling and Air Monitoring for Superfund Air Pathway Analysis

3.9.1 Evaluation of Baseline Air Emissions

Prior to conducting the proposed additional site drilling, air monitoring will be conducted to evaluate baseline emissions from the landfill in its present state. Gas samples will be collected for the qualitative and quantitative analysis of Target Compound List (TCL) VOCs via gas chromatography/mass spectrometry. Samples will be collected in accordance with EPA Method TO-14, "Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using Summa Passivated Canister Sampling and Gas Chromatographic Analysis" as found in the EPA publication Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air (EPA 600/4-84-041), or alternate approved EPA methodology. One sample will be collected from each of the six landfill gas vents to evaluate VOC emissions from these potential sources. Additional quality control samples, including blanks and duplicates, will be collected as specified in the method. In addition, the gas flow rate from each vent will be measured using a micromanometer, soap film flowmeter, or alternate low-flow measurement device. VOC concentration and vent gas flow information will be used to calculate the VOC emission rate from the landfill vents.

In addition to the vent sampling, area sampling will be conducted to evaluate the on-site and off-site levels of VOCs. One sample location will be on the upwind site perimeter boundary, two locations will be on the downwind perimeter boundary, and one location will be in the adjacent housing area. Sample locations will be selected using prevailing wind direction data collected with a portable meteorological station located on-site for a minimum of three days prior to sampling. The meteorological station will record wind speed, wind direction, temperature, and barometric pressure to document ambient conditions prior to and during testing. One time-integrated sample will be collected at each of the above-described sample locations, and additional quality control samples including blanks and duplicates will be collected as specified in the Method.

Using data generated from the vent and area emissions sampling, computer dispersion modeling will be conducted to determine off-site (i.e., outside of the post) impact of the landfill on nearby residential areas.

3.9.2 Evaluation of Emissions During Drilling

Air monitoring will be conducted during drilling activity both to protect the health of on-site workers and to warn of potential adverse exposures to nearby sensitive receptors.

After the completion of the baseline air monitoring program, the data will be evaluated and target compounds will be selected for monitoring during drilling. Target compound selection criteria will include relative abundance, toxicity, and ability to monitor low levels on a real-time basis.

Action levels will be established for the selected target compounds. Action levels will be used to trigger upgrading the level of respiratory protection used by on-site workers. Action levels will also be used to protect off-site receptors. Based on the predicted off-site impact developed from the computer dispersion modeling, action levels will be established for the site above which measures must be taken to protect nearby receptors. Mitigative action may include: utilization of vapor-suppressing techniques during drilling, postponing work pending more favorable meteorological conditions, evacuating nearby residences, or other measures.

The sample method chosen will be highly dependent on which VOCs are selected as target compounds, and what action levels have been established. The preferred methodology is direct-reading instrumentation, which would provide an instantaneous read-out of VOC levels, enabling rapid response to action level exceedances. Alternately, if action levels have been established at a level too low to be detected by direct-reading instrumentation, a sampling method with on-site analysis (such as a portable gas chromatograph) may be used.

As with the baseline study, meteorological data including wind speed, wind direction, and barometric pressure will be recorded during the air monitoring period.

3.9.3 Interpretation of Results

To evaluate the impact of allowing the landfill to exist in its present condition (i.e., no remedial action or gas treatment), a health risk assessment will be conducted. Using the results of the baseline vent and area sampling, and the computer dispersion model predicted off-site impacts, a risk factor associated with toxic air emissions from the landfill will be calculated. The level of risk determined for this site will then be compared to the EPA acceptable risk levels to determine if untreated air emissions from the landfill present an unacceptable risk to the public health.

The final RI report will include a summary of the test procedures used, results of the air monitoring, and interpretation of the results.

3.10 BIOLOGICAL SURVEY

The biological survey will collect and identify aquatic and terrestrial flora and fauna present at Fort Sheridan, and will provide data for wetland and floodplain assessments. Components of the biological survey will include an aquatic survey, a terrestrial survey, and a wetland and floodplain evaluation. The types of biological studies are described in the following paragraphs.

Aquatic Survey. The aquatic survey will consist of a qualitative collection and identification of aquatic fauna in and along the shore of Lake Michigan and the fish pond. Fauna will be collected with benthic dredge, aquatic dip net, and/or fish seine, as appropriate. Organisms will be preserved in 70-percent ethanol and identified in the laboratory to the species level, where possible. Physical parameters to be measured include dissolved oxygen, pH, temperature, salinity, and specific conductance.

Terrestrial Survey. The terrestrial survey will consist of the identification of terrestrial vegetation cover types (i.e., herbaceous plants, emergents, shrubs, and trees) and a visual survey for terrestrial wildlife (i.e., mammals, reptiles, amphibians, and birds). Local wildlife officials will be contacted to determine terrestrial species reported to be in the area or to inhabit the types of vegetative cover identified. Additional information will be collected for use in wetlands and floodplains assessments, including identification of soil types and wetland vegetation.

3.11 TOPOGRAPHIC AND ELEVATION SURVEY

To provide survey control for the geophysical magnetometer surveys, a baseline will be established for each of the landfills prior to initiation of field activities.

A topographic survey will be compiled for all sites to be evaluated under this project. Topographic maps will use a scale of 1 inch equals 100 feet, and a 2-foot contour interval. The topographic survey will be conducted by a licensed surveyor under contract to the RI contractor. Universal Transverse Mercator (UTM) or State Planar grid will be used as a reference for horizontal control to an accuracy of within ±3 feet. The Geodetic Datum of 1929 will be used as a reference for the vertical survey. These maps will contain all surface features pertinent to the site and the investigation, including borings, test pits, wells, and other sampling points installed as part of this RI.

Upon completion of well construction the natural ground surface and the uncapped inner casing (riser) for the monitoring wells will be surveyed for both vertical and horizontal control, to a degree of accuracy of ±0.05 and ±3 feet, respectively. Other exploration locations, such as test pits, will be surveyed for both vertical and horizontal control, to a degree of accuracy of ±0.1 foot and ±3 feet, respectively. The measuring point for test pits will be the estimated center of the test pit.

4.0 CHEMICAL ANALYSIS PROGRAM

4.1 CHEMICAL ANALYSIS

Chemical analysis will be performed by a USATHAMA-certified laboratory in accordance with the requirements of the USATHAMA QA Plan and the Quality Assurance Program Plan for Fort Sheridan. The laboratory must also have any certifications required by the State of Illinois. Analytical data will be generated using Classes C1, 1A, and 1B USATHAMA-certified procedures. These procedures result in data considered equivalent to USEPA Level III and IV data. Certain analyses, such as total dissolved solids (TDS), alkalinity, oxygen demand, and total organic halogens (TOX), are not certified by USATHAMA; these are functionally equivalent to USEPA Level III data. DQOs for Fort Sheridan are identified by medium in the following items.

- Groundwater, surface water, sediment, and soil samples collected during the RI field program will be analyzed by USATHAMA methods to provide Level III and Level IV data.

- Soil samples from the test pits and borings will be screened in the field with a photoionization detector (PID) providing Level I data to assist in selecting samples for laboratory analysis.

- Air quality will be monitored by a PID, providing Level I data.

- Temperature, pH, and specific conductance will be monitored in the field for surface water and groundwater samples, providing Level I data.

- In addition to TCL VOCs, SVOCs, elements, pesticides/PCBs, and herbicides, groundwater samples collected at the landfills will be analyzed for typical landfill monitoring parameters, providing Level III data. The landfill parameters (classical parameters) include fluoride, nitrate, hardness, sulfate, chloride, total organic carbon (TOC), chemical oxygen demand (COD), boron, alkalinity, and total dissolved solids.

- Waste characterization samples collected from waste materials (soil and water) generated from the field program, will be analyzed for RCRA waste characterization parameters (reactivity, ignitability, corrosivity, and EP Toxicity), providing Level III data. This data, along with the data from the field program, will be used to determine the disposal method for each type of waste.

Sample holding times, container requirements, and preservation techniques are described in detail in Section 3 of the Quality Assurance Program Plan (Data Item A006). Specific chemical analysis methods and QC requirements are described in the following section.

4.2 CHEMICAL ANALYSIS METHODS

This section describes the analytical methods for groundwater, soil, surface water, and sediment samples collected during the RI field program. Specific methods cannot be referenced until a laboratory is selected because protocols are dependent upon the methods for which a laboratory is certified. Specific methods can be assigned once a laboratory is selected. General analytical procedures and classes of analytes and matrices are summarized in Table 4-1; and an example list of certified parameters (taken from a typical USATHAMA approved laboratory) and applicable concentration ranges for these methods are presented in Table 4-2.

4.2.1 VOCs in Water by GC/MS

This GC/MS method covers the determination of purgeable organics in environmental water samples. The parameters determined by this method are shown in Table 4-2.

This method is based on the direct purging of a water sample. An aliquot of solution containing surrogates and internal standards is added to a measured volume of water in a purging device. This mixture is purged with helium at ambient temperature, and the purgeable organics are collected and concentrated on a polymer trap. The trap is thermally desorbed and the purgeable organics are then analyzed by GC/MS. The internal standards typically used are bromochloromethane, 1,4-difluorobenzene, and chlorobenzene-d_5. The surrogates typically used are 1,2-dichloroethane-d_4, ethylbenzene-d_{10}, methylene chloride-d_2, and toluene-d_8.

The tested concentration range for VOCs is approximately 1.0 to 400 μg/L but varies within that range for each analyte. The reporting range for each analyte is shown in Table 4-2.

4.2.2 VOCs in Soil by GC/MS

This GC/MS method covers the determination of purgeable organics in environmental soil samples. The parameters determined by this method are shown in Table 4-2.

This method is based on the direct purging of a soil sample. An aliquot of aqueous solution containing surrogates and internal standards is added to a weighed quantity of soil in a purging device. This mixture is purged with helium at ambient temperature, and the purgeable organics are collected and concentrated on a polymer trap. The trap is thermally desorbed, and the purgeable organics are then analyzed by GC/MS. The internal standards typically are bromochloromethane, 1,4-difluorobenzene, and chlorobenzene-d_5. The surrogates typically used are 1,2-dichloroethane-d4, ethylbenzene-d_{10}, toluene-d_8, and 4-bromofluorobenzene.

The tested concentration range for the VOCs is approximately 0.001 to 0.10 μg/g but varied for each analyte. The reporting range for each analyte is shown in Table 4-2.

TABLE 4-1
ANALYTICAL PROGRAM

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

MEDIA	PARAMETER	METHOD	USATHAMA CERTIFICATION CLASS	DQO LEVEL
Soils/Sediments	TCL VOCs	Purge and Trap GC/MS	1A	IV
	TCL SVOCs	GC/MS	1A	IV
	TCL Elements	AAS/PES	C1	IV
	TCL Pesticides/PCBs	GC/ECD	1B	IV
	Herbicides (2,4-D and 2,4,5-TP)	GC/ECD	--	III
	TOC	Combustion	--	III
	Asbestos	Microscopy	--	III
	Nitroaromatics	HPLC	CI	III
	EP Toxicity	Extraction/AAS/PES	CI	IV
	Ignitability	Pensky-Martens	--	III
	Cyanide	Colorimetric	--	III
	Sulfide	Colorimetric	--	III
	Corrosivity	pH	--	III
Surface Water/Groundwater	TCL VOCs	Purge and Trap GC/MS	1A	IV
	TCL SVOCs	GC/MS	1A	IV
	TCL Elements	AAS/PES	C1	IV
	TCL Pesticides/PCBs	GC/ECD	1B	IV
	Herbicides (2,4-D and 2,4,5-TP)	GC/ECD	--	III
	Nitroaromatics	HPLC	CI	III
	Hardness	Colorimetric	--	III
	Total Organic Carbon	Combustion	--	III
	Nitrate	Ion Chromatography	C1	III
	Fluoride	Ion Chromatography	C1	III
	Sulfate	Ion Chromatography	C1	III
	Chloride	Ion Chromatography	C1	III
	Chemical Oxygen Demand	Titrimetric	--	III
	Boron	PES	C1	III
	Alkalinity	Titrimetric	--	III
	Total Dissolved Solids	Gravimetric	--	III
	pH (field)	Potentiometric	--	I
	Specific Conductance (field)	Conductivity	--	I
	Temperature (field)	Thermometric	--	I

TABLE 4-1
(continued)
ANALYTICAL PROGRAM

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

MEDIA	PARAMETER	METHOD	USATHAMA CERTIFICATION CLASS	DQO LEVEL
Transformer Fluids	Polychlorinated Biphenyls	GC/ECD	1A	III
Wipes	Polychlorinated Biphenyls	GC/ECD	1A	III

NOTES:

VOC - Volatile Organic Compound
SVOC - Semivolatile Organic Compound
GC/MS - gas chromatography/mass spectrometry
AAS - atomic absorption spectroscopy
PES - plasma emission spectroscopy
TCL - Target Compound List, current USEPA Contract Laboratory Statement of Work
GC/ECD - gas chromatography/electron capture detector
DQO - Data Quality Objective
HPLC - High performance liquid chromatography

Refer to EPA 600/4-81-045, "The Determination of Polychlorinated Biphenyls in Transformer Fluid and Oils" for Measurement of PCBs in Transformer Fluids.

Analysis of the hexane solvent associated with wipe samples to determine PCBs is done by direct injection gas chromatography in accordance with Test Method 8080 in "Test Methods for Evaluating Solid Wastes," USEPA SW-840, September 1986.

TABLE 4-2
TYPICAL CONCENTRATION RANGES FOR USATHAMA CERTIFIED ANALYTICAL METHODS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

ANALYTE/MATRIX INSTRUMENT	ANALYTE	APPLICABLE CONCENTRATION RANGE MINIMUM (µg/L)	MAXIMUM (µg/L)
Metals/Water/CVAA	mercury (Hg)	0.100	2.000
Metals/Water/GFAA	lead (Pb)	2.160	20.000
Metals/Water/GFAA	selenium (Sc)	6.520	40.000
Metals/Water/GFAA	arsenic (As)	2.920	20.000
Metals/Water/GFAA	antimony (Sb)	2.170	30.000
Metals/Water/ICP	chromium (Cr)	4.440	5000.000
Metals/Water/ICP	nickel (Ni)	16.200	15000.000
Metals/Water/ICP	cadmium (Cd)	4.090	2500.000
Metals/Water/ICP	iron (Fe)	55.100	5000.000
Metals/Water/ICP	copper (Cu)	6.200	2000.000
Metals/Water/ICP	boron (B)	90.300	50000.000
Metals/Water/ICP	manganese (Mn)	2.880	2000.000
Metals/Water/ICP	cobalt (Co)	33.000	50000.000
Metals/Water/ICP	beryllium (Be)	2.920	500.000
Metals/Water/ICP	zinc (Zn)	5.350	2000.000
Metals/Water/ICP	magnesium (Mg)	110.000	25000.000
Metals/Water/ICP	vanadium (V)	4.000	8000.000
Metals/Water/ICP	aluminum (Al)	31.200	45000.000
Metals/Water/ICP	barium (Ba)	1.410	2000.000
Metals/Water/ICP	sodium (Na)	91.300	30000.000
Metals/Water/ICP	calcium (Ca)	22.600	2000.000
Metals/Water/ICP	potassium (k)	794.000	30000.000
Metals/Water/ICP	gold (Au)	5.560	1000.000
Anions/Water/Ionchrom	chloride	114.000	1000.000
Anions/Water/Ionchrom	fluoride	50.000	1000.000
Anions/Water/Ionchrom	nitrate	50.000	1000.000
Anions/Water/Ionchrom	sulfate	223.000	1000.000
Pesticides/Water/GCECD	P,P,-DDD	0.008	0.100
Pesticides/Water/GCECD	P,P,-DDE	0.014	0.100
Pesticides/Water/GCECD	P,P,-DDT	0.021	0.097
Pesticides/Water/GCECD	aldrin	0.012	0.098
Pesticides/Water/GCECD	chlordane	0.026	1.000
Pesticides/Water/GCECD	dieldrin	0.003	0.050
Pesticides/Water/GCECD	heptachlor	0.013	0.250
Pesticides/Water/GCECD	heptachlor epoxide	0.065	2.500
Pesticides/Water/GCECD	lindane	0.033	1.000
Pesticides/Water/GCECD	PCB-1016	0.140	1.000
Pesticides/Water/GCECD	PCB-1260	0.074	1.000

TABLE 4-2
(continued)
TYPICAL CONCENTRATION RANGES FOR USATHAMA CERTIFIED ANALYTICAL METHODS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

ANALYTE/MATRIX INSTRUMENT	ANALYTE	APPLICABLE CONCENTRATION RANGE MINIMUM ($\mu g/L$)	MAXIMUM ($\mu g/L$)
Volatiles/Water/GCMS	methylene chloride	1.800	400.000
Volatiles/Water/GCMS	1,2-dichloroethane	1.000	400.000
Volatiles/Water/GCMS	ethylbenzene	1.200	400.000
Volatiles/Water/GCMS	1,1,1-trichloroethane	1.000	400.000
Volatiles/Water/GCMS	1,1,2,2-tetrachloroethane	7.100	100.000
Volatiles/Water/GCMS	1,1,2-trichloroethane	1.700	200.000
Volatiles/Water/GCMS	1,1-dichloroethane	2.700	400.000
Volatiles/Water/GCMS	1,1-dichloroethene	6.800	200.000
Volatiles/Water/GCMS	1,2-dichlorobenzene	6.900	400.000
Volatiles/Water/GCMS	1,2-dichloroethane	1.000	400.000
Volatiles/Water/GCMS	1,2-dichloroethene	2.200	400.000
Volatiles/Water/GCMS	1,2-dichloropropane	3.200	200.000
Volatiles/Water/GCMS	1,2-dichloropropene	3.300	400.000
Volatiles/Water/GCMS	cis-1,3-dichloropropane	1.800	400.000
Volatiles/Water/GCMS	trans-1,3-dichloropropene	1.600	200.000
Volatiles/Water/GCMS	1,4-dichlorobenzene	2.500	100.000
Volatiles/Water/GCMS	2-chloroethylvinylether	1.600	200.000
Volatiles/Water/GCMS	benzene	1.700	400.000
Volatiles/Water/GCMS	bromoform	3.700	200.000
Volatiles/Water/GCMS	carbon tetrachloride	1.000	400.000
Volatiles/Water/GCMS	chlorobenzene	1.200	400.000
Volatiles/Water/GCMS	chloroethane	6.900	100.000
Volatiles/Water/GCMS	chloroform	1.000	400.000
Volatiles/Water/GCMS	chloromethane	1.800	200.000
Volatiles/Water/GCMS	dibromochloromethane	1.800	400.000
Volatiles/Water/GCMS	ethylbenzene	1.400	400.000
Volatiles/Water/GCMS	trichloroethylene	2.300	400.000
Volatiles/Water/GCMS	toluene	1.800	400.000
Volatiles/Water/GCMS	tetrachloroethane	1.000	400.000
Volatiles/Water/GCMS	vinyl chloride	13.000	100.000
Organics/Water/GCMS	1,2,4-trichlorobenzene	4.600	200.000
Organics/Water/GCMS	1,2-dichlorobenzene	5.200	100.000
Organics/Water/GCMS	1,3-dichlorobenzene	5.500	100.000
Organics/Water/GCMS	1,4-dichlorobenzene	6.000	200.000
Organics/Water/GCMS	2,4-dinitrotoluene	5.400	100.000
Organics/Water/GCMS	aldrin	1.300	100.000
Organics/Water/GCMS	acenaphthalene	3.700	100.000
Organics/Water/GCMS	bis(2-ethylhexyl)phthalate	0.830	100.000
Organics/Water/GCMS	benzo(a)pyrene	4.500	10.000
Organics/Water/GCMS	benzo(a)pyrene	2.400	100.000

TABLE 4-2
(continued)
TYPICAL CONCENTRATION RANGES FOR USATHAMA CERTIFIED ANALYTICAL METHODS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

ANALYTE/MATRIX INSTRUMENT	ANALYTE	APPLICABLE CONCENTRATION RANGE MINIMUM (μg/L)	MAXIMUM (μg/L)
Organics/Water/GCMS	beta-BHC	38.000	100.000
Organics/Water/GCMS	benzo(g,h,i)perylene	2.900	10.000
Organics/Water/GCMS	benzo(b)fluoranthene	3.200	200.000
Organics/Water/GCMS	hexachlorobenzene	8.200	40.000
Organics/Water/GCMS	naphthalene	4.000	100.000
Organics/Water/GCMS	nitrobenzene	7.400	200.000
Organics/Water/GCMS	pyrene	12.000	200.000
Organics/Water/GCMS	1,2,3-trichlorobenzene	6.500	100.000
Organics/Water/GCMS	diethylphthalate	11.000	400.000
Organics/Water/GCMS	2,6-dinitrotoluene	5.100	100.000
Organics/Water/GCMS	1,3-dichlorobenzene	0.890	400.000
Organics/Water/GCMS	2-chlorophenol	8.400	400.000
Organics/Water/GCMS	P,P-DDD	6.000	200.000
Organics/Water/GCMS	chlorobenzene	2.800	200.000
Organics/Water/GCMS	hexachlorobutadiene	6.000	100.000
Organics/Water/GCMS	P,P-DDE	12.000	100.000
Organics/Water/GCMS	P,P-DDT	4.700	100.000
Organics/Water/GCMS	aldrin	6.300	200.000
Organics/Water/GCMS	anthracene	1.100	100.000
Organics/Water/GCMS	acenaphthalene	1.600	200.000
Organics/Water/GCMS	bis(2-ethylhexyl)phthalate	34.000	400.000
Organics/Water/GCMS	hexachloroethane	12.000	100.000
Organics/Water/GCMS	chrysene	1.000	200.000
Organics/Water/GCMS	delta-BHC	95.000	200.000
Organics/Water/GCMS	di-n-octylphthalate	18.000	100.000
Organics/Water/GCMS	dibenz(a,h)anthracene	4.900	40.000
Organics/Water/GCMS	dieldrin	3.500	40.000
Organics/Water/GCMS	endrin	51.000	300.000
Organics/Water/GCMS	lindane	15.000	100.000
Explosives/Water/HPLC	1,3,5-trinitrobenzene	0.407	96.0
Explosives/Water/HPLC	1,3-dinitrobenzene	0.353	96.0
Explosives/Water/HPLC	2,4,6-trinitrotoluene	0.758	96.0
Explosives/Water/HPLC	2,4-dinitrotoluene	0.314	96.0
Explosives/Water/HPLC	2,6-dinitrotoluene	0.257	96.0
Explosives/Water/HPLC	HMX	5.83	96.0
Explosives/Water/HPLC	nitrobenzene	1.52	96.0
Explosives/Water/HPLC	RDX	4.73	48.0
Explosives/Water/HPLC	Tetryl	2.04	96.0

TABLE 4-2
(continued)
TYPICAL CONCENTRATION RANGES FOR USATHAMA CERTIFIED ANALYTICAL METHODS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

ANALYTE/MATRIX INSTRUMENT	ANALYTE	APPLICABLE CONCENTRATION RANGE MINIMUM (mg/kg)	MAXIMUM (mg/kg)
Metals/Soil/CVAA	mercury (Hg)	0.018	0.400
Metals/Soil/GFAA	selenium (Se)	1.950	20.000
Metals/Soil/GFAA	arsenic (As)	2.220	40.000
Metals/Soil/GFAA	thallium (Tl)	2.320	20.000
Metals/Soil/GFAA	antimony (Sb)	0.373	6.000
Metals/Soil/ICP	boron (B)	70.600	5000.000
Metals/Soil/ICP	calcium (Ca)	79.000	1000.000
Metals/Soil/ICP	cadmium (Cd)	0.951	250.000
Metals/Soil/ICP	copper (Cu)	6.290	40.000
Metals/Soil/ICP	iron (Fe)	1.520	50.000
Metals/Soil/ICP	magnesium (Mg)	2.200	125.000
Metals/Soil/ICP	sodium (Na)	42.400	3000.000
Metals/Soil/ICP	nickel (Ni)	1.820	150.000
Metals/Soil/ICP	zinc (Zn)	8.380	200.000
Metals/Soil/ICP	lead (Pb)	92.300	750.000
Metals/Soil/ICP	cobalt (Co)	18.600	5000.000
Metals/Soil/ICP	potassium (k)	142.000	2000.000
Metals/Soil/ICP	chromium (Cr)	9.310	500.000
Metals/Soil/ICP	beryllium (Be)	0.331	50.000
Metals/Soil/ICP	barium (Ba)	7.980	40.000
Metals/Soil/ICP	vanadium (V)	61.700	800.000
Metals/Soil/ICP	silver (Ag)	0.699	25.000
Metals/Soil/ICP	manganese (Mn)	292.000	2000.000
Anions/Soil/Ionchrom	fluoride	10.600	100.000
Anions/Soil/Ionchrom	chloride	32.600	100.000
Anions/Soil/Ionchrom	nitrate	1.630	10.000
Anions/Soil/Ionchrom	sulfate	14.000	100.000
Pesticides/Soil/GCECD	p,p-DDD	0.017	0.500
Pesticides/Soil/GCECD	p,p-DDE	0.014	0.500
Pesticides/Soil/GCECD	p,p-DDT	0.017	0.250
Pesticides/Soil/GCECD	aldrin	0.011	0.250
Pesticides/Soil/GCECD	chlorodane	0.028	0.400
Pesticides/Soil/GCECD	dieldrin	0.006	0.500
Pesticides/Soil/GCECD	heptachlor	0.013	0.500
Pesticides/Soil/GCECD	heptachlor epoxide	0.094	1.000
Pesticides/Soil/GCECD	Lindane	0.044	0.400
Pesticides/Soil/GCECD	PCB-1016	0.063	1.000
Pesticides/Soil/GCECD	PCB-1260	0.049	1.000

TABLE 4-2
(continued)
TYPICAL CONCENTRATION RANGES FOR USATHAMA CERTIFIED ANALYTICAL METHODS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

ANALYTE/MATRIX INSTRUMENT	ANALYTE	APPLICABLE CONCENTRATION RANGE MINIMUM (mg/kg)	MAXIMUM (mg/kg)
Organics/Soil/GCMS	1,2,3-trichlorobenzene	0.190	4.000
Organics/Soil/GCMS	1,2,4-trichlorobenzene	0.170	4.000
Organics/Soil/GCMS	1,2-dichlorobenzene	0.330	4.000
Organics/Soil/GCMS	1,3-dichlorobenzene-d4	0.530	2.000
Organics/Soil/GCMS	1,3-dichlorobenzene	0.300	4.000
Organics/Soil/GCMS	1,4-dichlorobenzene	0.290	4.000
Organics/Soil/GCMS	2,4-dinitrotoluene	0.460	4.000
Organics/Soil/GCMS	2,6-dinitrotoluene	0.200	4.000
Organics/Soil/GCMS	2-chlorophenol-dr	0.420	2.000
Organics/Soil/GCMS	2-chloronaphthalene	0.320	4.000
Organics/Soil/GCMS	2-chloronaphthalene	0.420	4.000
Organics/Soil/GCMS	aldrin	0.340	4.000
Organics/Soil/GCMS	acenaphthene	0.310	4.000
Organics/Soil/GCMS	acenaphthylene	0.290	10.000
Organics/Soil/GCMS	anthracene	0.380	10.000
Organics/Soil/GCMS	bis(2-chloroethyl)ether	0.650	10.000
Organics/Soil/GCMS	bis(2-ethylhexyl)phthalate	0.270	10.000
Organics/Soil/GCMS	benzo(a)anthracene	0.160	10.000
Organics/Soil/GCMS	benzo(a)pyrene	0.250	10.000
Organics/Soil/GCMS	benzo(b)fluoranthene	0.330	40.000
Organics/Soil/GCMS	beta-BHC	0.520	10.000
Organics/Soil/GCMS	benzo(g,h,i)perylene	0.220	10.000
Organics/Soil/GCMS	benzo(k)fluoranthene	0.190	10.000
Organics/Soil/GCMS	chrysene	0.350	4.000
Organics/Soil/GCMS	hexachlorobenzene	0.140	4.000
Organics/Soil/GCMS	hexachloroethane	0.810	4.000
Organics/Soil/GCMS	dibenz(a,h)anthracene	0.570	2.000
Organics/Soil/GCMS	delta-BHC	0.570	4.000
Organics/Soil/GCMS	diethylphthalate-d4	0.620	2.000
Organics/Soil/GCMS	dieldrin	0.860	4.000
Organics/Soil/GCMS	di-n-octylphthalate	0.350	10.000
Organics/Soil/GCMS	endrin	0.380	4.000
Organics/Soil/GCMS	fluoranthene	0.210	4.000
Organics/Soil/GCMS	hexachlorobutadiene	0.290	4.000
Organics/Soil/GCMS	heptachlor	0.270	4.000
Organics/Soil/GCMS	heptachlor epoxide	0.740	10.000
Organics/Soil/GCMS	indeno(1,2,3-c,d)pyrene	0.450	4.000

TABLE 4-2
(continued)
TYPICAL CONCENTRATION RANGES FOR USATHAMA CERTIFIED ANALYTICAL METHODS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

ANALYTE/MATRIX INSTRUMENT	ANALYTE	APPLICABLE CONCENTRATION RANGE MINIMUM (mg/kg)	MAXIMUM (mg/kg)
Organics/Soil/GCMS	lindane	0.300	4.000
Organics/Soil/GCMS	naphthalene	0.280	4.000
Organics/Soil/GCMS	nitrobenzene-d5	0.250	2.000
Organics/Soil/GCMS	N-nitroso-di-n-propylamine	0.110	4.000
Organics/Soil/GCMS	phenanthrene	1.600	10.000
Organics/Soil/GCMS	p,p-DDD	0.390	4.000
Organics/Soil/GCMS	p,p-DDE	0.400	4.000
Organics/Soil/GCMS	p,p-DDT	0.480	10.000
Organics/Soil/GCMS	pyrene	0.530	2.000
Volatiles/Soil/GCMS	1,1,1-trichloroethane	0.006	0.100
Volatiles/Soil/GCMS	1,1,2,2-tetrachloroethane	0.003	0.100
Volatiles/Soil/GCMS	1,1,2-trichloroethane	0.006	0.100
Volatiles/Soil/GCMS	1,1-dichloroethane	0.007	0.100
Volatiles/Soil/GCMS	1,1-dichloroethene	0.012	0.100
Volatiles/Soil/GCMS	1,2-dichlorobenzene	0.009	0.040
Volatiles/Soil/GCMS	1,2-dichloroethane	0.005	0.100
Volatiles/Soil/GCMS	1,2-dichloroethane-d4	0.004	0.100
Volatiles/Soil/GCMS	1,2-dichloroethene	0.006	0.100
Volatiles/Soil/GCMS	1,2-dichloropropane	0.010	0.100
Volatiles/Soil/GCMS	1,3-dichloropropane	0.006	0.100
Volatiles/Soil/GCMS	cis-1,3-dichloropropene	0.003	0.100
Volatiles/Soil/GCMS	trans-1,3-dichloropropene	0.002	0.100
Volatiles/Soil/GCMS	1,4-dichlorobenzene	0.008	0.100
Volatiles/Soil/GCMS	2-chloroethylvinylether	0.005	0.100
Volatiles/Soil/GCMS	benzene	0.005	0.100
Volatiles/Soil/GCMS	4-bromo fluorobenzene	0.007	0.100
Volatiles/Soil/GCMS	bromoform	0.004	0.100
Volatiles/Soil/GCMS	carbon tetrachloride	0.002	0.100
Volatiles/Soil/GCMS	chlorobenzene	0.002	0.040
Volatiles/Soil/GCMS	chloroethane	0.010	0.100
Volatiles/Soil/GCMS	chloroform	0.015	0.044
Volatiles/Soil/GCMS	chloromethane	0.004	0.100
Volatiles/Soil/GCMS	dibromochloromethane	0.002	0.100
Volatiles/Soil/GCMS	ethylbenzene	0.010	0.100
Volatiles/Soil/GCMS	trichloroethene	0.008	0.100
Volatiles/Soil/GCMS	toluene	0.006	0.100
Volatiles/Soil/GCMS	toluene-d8	0.010	0.100
Volatiles/Soil/GCMS	tetrachloroethene	0.002	0.100
Volatiles/Soil/GCMS	vinyl chloride	0.008	0.040

TABLE 4-2
(continued)
TYPICAL CONCENTRATION RANGES FOR USATHAMA CERTIFIED ANALYTICAL METHODS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

ANALYTE/MATRIX INSTRUMENT	ANALYTE	APPLICABLE CONCENTRATION RANGE MINIMUM (mg/kg)	MAXIMUM (mg/kg)
Explosives/Soil/HPLC	1,3,5-trinitrobenzene	1.84	46.9
Explosives/Soil/HPLC	1,3-dinitrobenzene	1.31	102.0
Explosives/Soil/HPLC	2,4,6-trinitrobenzene	4.78	97.6
Explosives/Soil/HPLC	2,4-dinitrobenzene	3.38	88.0
Explosives/Soil/HPLC	2,6-dinitrobenzene	0.98	95.2
Explosives/Soil/HPLC	HMX	4.42	100.0
Explosives/Soil/HPLC	nitrobenzene	5.68	50.0
Explosives/Soil/HPLC	RDX	3.94	100.0
Explosives/Soil/HPLC	Tetryl	4.86	50.0

4.2.3 SVOCs in Water by GC/MS

This method covers the determination of organic compounds that are partitioned into an organic solvent from water and are amenable to GC/MS analysis. The parameters determined by this method are shown in Table 4-2.

A measured volume of water is extracted with methylene chloride, and the extract is dried and concentrated to 1 mL by evaporation. Quantification is performed using GC/MS. The internal standards typically used are 1,4-dichlorobenzene-d_4, naphthalene-d_8, acenaphthene-d_{10}, phenanthrene-d_{10}, chrysene-d_{12}, and perylene-d_{12}. Typical surrogates used are 2-fluorobiphenyl, nitrobenzene, terphenyl 1-d_{14}, phenol-d_5, 2-fluorophenol, and 2,4,6-tribromophenol.

4.2.4 SVOCs in Soil by GC/MS

This method covers the determination of organic compounds that are partitioned into an organic solvent from soil and are amenable to GC/MS analysis. The parameters certified for analysis by this method are shown in Table 4-2.

A measured weight of soil is mixed with anhydrous sodium sulfate and extracted with 1:1 methylene chloride/acetone using an ultrasonic probe. The extract is filtered and concentrated by evaporation. Quantification is performed using GC/MS with the following internal standards: 1,4-dichlorobenzene-d_4, naphthalene-d_8, acenaphthene-d_{10}, phenanthrene-d_{10}, chrysene-d_{12}, and perylene-d_{12}. Typical surrogates used are 2-fluorobiphenyl, nitrobenzene-d_5, terphenyl-d_{14}, phenol-d^5, 2-fluorophenol, and 2,4,6-tribromophenol. The reporting range for each analyte is listed in Table 4-2.

4.2.5 Elements in Water By AAS, Graphite Furnace Technique

This method is applicable to the determination of selected elements in water samples by the atomic absorption spectroscopy (AAS), graphite furnace technique. A representative aliquot of a digested sample is placed in the graphite tube in the furnace, evaporated to dryness, charred, and atomized. A greater percentage of available analyte atoms are vaporized and dissociated for absorption in the tube than in normal direct aspiration AAS using a flame. Consequently, this method is more applicable for detection of low concentrations of elements. The characteristic radiation from a given excited element is passed through the vapor containing ground state atoms of that element; the concentration of the element is determined by the intensity of the transmitted radiation.

The metals for which this method may be used are Pb, Se, Tl, and As. The tested concentration ranges and reporting limits (lowest concentration in tested range) are listed for each analyte in water samples in Table 4-2.

4.2.6 Elements in Soil by AAS, Graphite Furnace Technique

This method is applicable to the determination of elements in soil samples by the AAS, graphite furnace technique. The technique is the same as that described in Section 4.2.5 for metals in water. The metals for which this method may be used are Se, As, Tl, and Pb.

The tested concentration ranges and reporting limits (lowest concentration is tested range) are listed for each analyte in soil samples in Table 4-2.

4.2.7 Trace Elements in Water by ICAP Atomic Emission Spectrometry

This method is applicable to the determination of elements in water samples by Inductively Coupled Argon Plasma (ICAP) atomic emission spectometric analysis. In this method, samples are nebulized and element-specific, atomic-line emission/spectra are produced by radio frequency ICAP.

The intensity of the emitted lines is proportional to the concentration of the specific elements.

The metals to be analyzed by this method are the following: Al, Sb, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Mg, Mn, Ni, K, Ag, B, Na, V, and Zn. The tested concentration ranges and reporting limits (lowest concentration in tested range) are listed for each analyte in the water samples in Table 4-2.

4.2.8 Trace Elements in Soil by ICAP Atomic Emission Spectrometry

This method is applicable to the determination of the following metals in soil and sediment samples by ICAP atomic emission spectrometric analysis.

The method measures element-emitted light by optical spectrometry, as described in Section 4.2.7. The metals in soil samples to be analyzed using this method are as follows: Ca, Cd, Co, Cu, Fe, Mg, Ni, K, Zn, Cr, Be, Ba, V, Al, B, Ag, Mn, Na, and Sb. The tested concentration ranges and reporting limits (lowest concentration in tested range) are listed for each analyte in water in Table 4-2.

4.2.9 Mercury in Water by Cold Vapor Technique

This method is applicable to the determination of Hg in water samples by the cold vapor atomic absorption (AA) technique.

The flameless AA procedure is based on the absorption of radiation at 253.7 nm by Hg vapor. The Hg is reduced to the elemental state and aerated from solution in a closed system. The Hg vapor passes through a cell positioned in the light path of an AA spectrophotometer. Absorbance (peak height) is measured as a function of Hg concentration and recorded in the usual manner.

The calculated equivalent tested concentration in water for Hg is 0.1 to 2.0 μg/L, with 0.1 μg/L as the reporting limit. These parameters are included in Table 4-2.

4.2.10 Mercury in Soil by Cold Vapor Technique

This method is applicable to the determination of Hg in soil samples by the cold vapor AA technique, as described previously (see Section 4.2.15). The calculated equivalent tested concentration for Hg in soil is 0.0179 to 0.4 mg/kg

and the reporting limit is 0.0179 mg/kg. These parameters are included in Table 4-2.

4.2.11 Anions in Water by Ion Chromatography

This method is applicable to the determination of the following analytes: fluoride, chloride, nitrate, and sulfate. It is applicable to surface water, wastewater, and groundwater.

This method is based on the separation of anions by ion chromatography on an anion exchange column followed by quantification by conductivity measurement.

The tested concentration ranges and reporting limit (lowest concentration in tested range) are listed for each analyte in the water samples in Table 4-2.

4.2.12 Total Dissolved Solids (Filterable Residue)

This method is applicable to drinking, surface, and saline waters as well as domestic and industrial wastes. The practical range of the determination is 10 to 20,000 mg/L. Filterable residue is defined as those solids capable of passing through a glass fiber filter and dried to constant weight at 180°C. If "residue, non-filterable" is being determined, the filtrate from that method may be used for "residue, filterable."

4.2.13 Pesticides/PCBs in Water by GC/ECD

This method covers the determination pesticides/PCBs that are partitioned into an organic solvent from water and are amenable to GC/ECD analysis. The parameters determined by this method are shown in Table 4-2.

A measured volume of water is extracted with methylene chloride. The extract is dried, exchanged to hexane, and concentrated by evaporation. Quantitation is performed by external standard calibration. The reporting range for each analyte is listed in Table 4-2.

4.2.14 Pesticides/PCBs in Soil by GC/ECD

This method covers the determination of pesticides/PCBs that are partitioned into an organic solvent from soil and are amenable to GC/ECD analysis. The parameters determined by this method are shown in Table 4-2.

A measured weight of soil is mixed with anhydrous sodium sulfate and extracted with 1:1 methylene chloride/acetone using and ultrasonic probe. The extract is filtered, exchanged to hexane, and concentrated by evaporation. Quantitation is performed by external standard calibration. The reporting range for each analyte is listed in Table 4-2.

4.2.15 Herbicides in Water by GC/ECD

This method covers the analysis of herbicides (2,4-D and 2,4,5-TP) that are partitioned into an organic solvent from water and are amenable to GC/ECD analysis.

A measured volume of water is extracted at acid pH with diethyl ether. The extract is hydrolized, re-extracted with diethyl ether, concentrated by evaporation, and esterified with diazomethane. Quantitation is performed by external standard calibration.

4.2.16 Herbicides in Soil by GC/ECD

This method covers the analysis of herbicides (2,4-D and 2,4,5-TP) that are partitioned into an organic solvent from soil and are amenable to GC/ECD analysis.

A measured weight of soil is serially extracted with a diethyl ether acetone mixture (80/20). The extract is hydrolized, re-extracted with diethyl ether, concentrated by evaporation, and esterified with diazomethane. Quantitation is performed by external standard calibration.

4.2.17 Nitroaromatics in Water by HPLC

This method is applicable to the determination of the following compounds in water using acetonitrile (CH_3CN) extraction with subsequent analysis by High Performance Liquid Chromatography (HPLC) with ultraviolet detection: nitrobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 1,3-dinitrobenzene, 1,3,5-trinitrobenzene, 2,4,6-trinitrobenzene, tetryl, RDX, and HMX.

A measured volume of liquid is placed in a serum vial and is extracted with acetonitrile using a vortex mixer. The sample is filtered through a Rainin filter and the extract is analyzed by HPLC on a Zorbax column using UV detection with external standards.

The reporting range for each analyte is listed in Table 4-2.

4.2.18 Nitroaromatics in Soil by HPLC

This method is applicable to the determination of the following compounds in soil samples using acetonitrile extraction with subsequent analysis by HPLC with UV detection: nitrobenzene; 2,4-dinitrotoluene; 2,6-dinitrotoluene; 1,3-dinitrobenzene; 1,3,5-trinitrobenzene; 2,4,6-trinitrotoluene; tetryl, RDX, and HMX.

A measured weight of soil is placed in a serum vial and is extracted with CH_3CN using a vortex mixer. The sample is filtered through a Rainin filter and the extract is analyzed by HPLC on a Zorbax column using UV detection with external standards.

The reporting range for each analyte is listed in Table 4-2.

4.2.19 Total Hardness (mg/L as CaCO3)

This method is applicable to drinking, surface, and saline waters as well as domestic and industrial wastes. The method is suitable for all concentration ranges of hardness; however, in order to avoid large titration volumes, use a

sample aliquot containing not more than 25-mg calcium carbonate ($CaCO_3$). Automated titration may be used.

Ca and Mg ions in the sample are sequestered upon the addition of disodium ethylenediamine tetraacetate. The endpoint of the reaction is detected by means of Erichrome Black T indicator, which has red color in the presence of Ca and Mg and a blue color when the cations are sequestered.

4.2.20 Alkalinity

This method is applicable to drinking, surface, and saline waters as well as domestic and industrial wastes. The method is suitable for all concentration alkalinity ranges; however, appropriate aliquots should be used to avoid titration volume greater than 50 mL. Automated titrimetric analysis is equivalent.

An unaltered sample is titrated to an electrometrically determined endpoint of pH 4.5. The sample must not be filtered, diluted, concentrated, or altered in any way.

A pH meter of electrically operated titrator that uses a glass electrode and can be read to 0.05 pH units is needed; the instrument should be standardized and calibrated according to manufacturer's instructions. If automatic temperature compensation is not provided, make titration at 25 ±2°C.

4.2.21 Total Organic Carbon in Water

This method is applicable to the determination of material containing organic carbon in water. Organic carbon is measured using carbonaceous analyzer instrumentation. The instrument converts organic carbon into carbon dioxide which then is either measured by an infrared detector or converted to methane and measured by a flame ionization detector. A directly proportional relationship of organic carbon and carbon dioxide production is used to determine TOC in the sample. This method can be used to measure organic carbon down to 1 mg/L.

4.2.22 Total Organic Carbon in Soil

This method is applicable to the determination of TOC in soil. Organic carbon is measured by first treating the soil sample with 10-percent hydrochloric acid. The sample is dried in a desiccator, cupric oxide is added, and the sample is combusted in an induction furnace. The organic carbon content is determined through a calculation in which the sample weight change is multiplied by a method constant.

4.2.23 Chemical Oxygen Demand in Water

This method is applicable to the analysis of COD in surface water and domestic and industrial wastes. Oxidizable organic and inorganic constituents are

oxidized by potassium dichromate in sulfuric acid solution. Excess dichromate is titrated using ferrion indicator.

4.2.24 Polychlorinated Biphenyls in Transformer Fluid

This method is applicable to the determination of polychlorinated biphenyls (PCBs) in transformer fluid and waste oils. A diluted sample is injected into a gas chromatograph. Measurement is accomplished with a halogen-specific detector which maximizes baseline stability and minimizes interferences normally encountered with other detectors. The electron capture detector (ECD) can normally be substituted for the halogen-specific detector when samples contain dichloro through decachloro-biphenyl isomers (Arochlors 1016, 1232, 1242, 1248, 1254, 1260, 1262, and 1268). Additional information is contained in the EPA test method "The Determination of Polychlorinated Biphenyls in Transformer Fluid and Waste Oil" (USEPA, 1982).

4.2.25 Polychlorinated Biphenyls in Wipe Samples

The analyst adds a small amount of hexane (5 to 10 mL) to the container holding the wipe sample, covers the container, and shakes it well to wash the wipe with the hexane.

A sample of the hexane is then withdrawn and analyzed by direct injection gas chromatography (GC/ECD). Additional information concerning analysis is contained in EPA Method 8080 as presented in "Test Methods for Evaluating Solid Wastes" (USEPA, 1986).

4.2.26 Asbestos

A sample is placed on a microscope slide and examined using polarized light microscopy.

4.2.27 Extraction Procedure (EP) Toxicity

EP is applicable to the leaching of materials from wastes. A sample of waste is extracted for 24 hours with distilled water buffered to a mildly acidic pH (0.1N acetic acid at pH5). The resulting extract is then analyzed by the appropriate, USATHAMA certified analytical methods for water samples.

The analytes to be determined are As, Ba, Cd, Cr, Pb, Hg, Se, Ag. Endrin, Lindane; Toxaphene, Methoxychlor, 2,4-D, and 2,4,5-TP (Silvex).

4.2.28 Ignitability. The sample is heated at a constant rate in a Pensky-Martens closed-cup tester, and a flame is introduced at regular intervals. The flash point is the lowest temperature at which the flame ignites the vapor over the sample.

4.2.29 Reactivity. This method is applicable to all wastes and determines the rate of release of hydrocyanic acid (cyanide) and hydrogen sulfide on contact with aqueous acid.

A measured sample aliquot is acidified to pH2 in a closed system, and the gas generated is trapped in a scrubber containing sodium hydroxide solution. The cyanide in the scrubber is determined colorimetrically using a spectrophotometer. A separate portion of the scrubber solution is acidified to pH2, and treated with excess iodine. Sulfide is determined by back-titration of the iodine with sodium thiosulfate or phenylarsine oxide.

4.2.30 Corrosivity. The characteristic of corrosivity can be determined by measuring sample pH with a glass or combination electrode. The pH meter is calibrated using solutions of known pH.

4.3 DATA MANAGEMENT

Data generated through the implementation of field activities will be managed in accordance with USATHAMA data management procedures. Data for this project will include the chemical analysis data and the geotechnical data from the field drilling program. The chemical analysis data will be entered into the Installation Restoration Data Management System (IRDMS) by the laboratory under review/control by the RI/FS contractor. Computerized geotechnical field data will be entered by the RI/FS contractor. IRDMS geotechnical and sampling files (i.e., GMA, GFD, GWC, and GGS) will be required. All field-generated data will be entered on field log forms and field daily report forms for transmission to both the home office and USATHAMA. Data management is further described in the Quality Assurance Program Plan.

Data to be entered into the IRDMS will be coded, reviewed, and entered by the RI/FS contractor and/or the laboratory before required maximum suspense dates. The Management Plan Data will be provided in clear Tier 2 files (passed appropriate GEOTEST or CHEMICAL ACCEPTANCE ROUTINE). Validation/verification of the accuracy of data will occur before upgrade to Tier 2. All original log books, model outputs, and hard copy of chemical/geotechnical data will be supplied as Data Items A013-A015 (Informal Technical Data). Data not entered in the IRDMS will include geophysics. These will be transmitted by letter report and will be summarized and appended to the RI Report.

4.4 QUALITY ASSURANCE

Sampling and analysis of all matrices during the RI program will be carried out in accordance with the requirements of the USATHAMA Quality Assurance Program and specifications in the Quality Assurance Program Plan; samples will be properly handled and conveyed to the laboratory in accordance with specified chain-of-custody procedures. As indicated in Section 4.3, QA validation of each batch in accordance with MIL SPEC 105-B will be performed. This will include auditing data records supplied by the Laboratory regarding analytical data batches.

The laboratory QA/QC Coordinator will, on a weekly basis, provide the RI/FS contractor QA Supervisor with all system and performance audit reports; chain of custody logs; holding time/extraction analysis reports; batching reports;

instrument logs; maintenance and calibration records; and complete analytical QC documentation (control charts, method blanks, surrogate recovery, and matrix spike results). Copies of all corrective actions will be supplied to the RI/FS contractor for approval. While the laboratory provides operational control, the RI/FS contractor, QA Supervisor retains ultimate responsibility for data quality. The QA Supervisor will be forwarded all of the above data along with the weekly QC report (Data Item A008, Quality Assurance Program Status Report) for review. The QA Supervisor will review all analytical lot QC data before submittal of the required A008 report. This report is due five working days after completion of analysis.

5.0 SITE-SPECIFIC EXPLORATIONS

This section of the Sampling and Analysis Plan contains individual site descriptions, technical objectives, and proposed exploration and sampling programs. The draft Enhanced Preliminary Assessment identified 14 sites with known or suspected releases of hazardous substances. RI programs have been developed for all of these sites, plus 27 additional sites or site groups identified during an October 1989 site visit and subsequent data review. The sites have been separated into eleven categories based on the nature and type of operation, and include:

- Landfills
- Coal Storage Areas
- Underground Storage Tanks
- Vehicle and Equipment Storage Areas and Open Storage Areas
- Miscellaneous Yard Areas
- Buildings
- NIKE Missile Installation
- Storm Drainage and Ravine System
- Pole-Mounted Transformers
- Asbestos Containing Materials in Buildings
- Small Arms and Coastal Artillery Impact Areas

Table 5-1 summarizes the exploration programs at each of the site categories.

Throughout this section it is assumed that the geophysical survey proceeds the test pit program, and that the test pit program precedes the soil boring program.

5.1 LANDFILLS

There are seven identified former landfills which received industrial and municipal waste from post operations at Fort Sheridan from installation start-up in 1888 until 1979. Review of the Enhanced PA and other available data indicates that all seven landfills received any type of waste generated on-post. In addition, Landfill No. 7 is the most likely to have received transformers containing PCBs.

The RI programs to be conducted at Landfills Nos. 1 through 7 are described in the following sections. Figure 5-1 shows the locations of the landfills. Table 5-2 summarizes the backhoe, drilling, and monitoring well programs, and Table 5-3 summarizes the sampling and analytical programs for the landfills.

5.1.1 Landfill No. 1

5.1.1.1 Site Description. Landfill No. 1 is located at the far northwestern corner of Fort Sheridan in a branch of Janes Ravine. According to Bonds, it operated from approximately 1940 through the early 1950s and received general refuse (Bonds, 1987). Open burning was conducted at this site before the soil cover was completed. USEPA's Environmental Photographic Interpretation Center

TABLE 5-1
SUMMARY OF EXPLORATION PROGRAM

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

SITE	TEST PITS	SOIL BORINGS SHALLOW	SOIL BORINGS WITH MON. WELLS SHALLOW	SOIL BORINGS WITH MON. WELLS DEEP	BORING DEPTH[1] (L.F.)	NO. OF SPLIT-SPOON SAMPLES CONT. (NO.)	NO. OF SPLIT-SPOON SAMPLES 5-FOOT[2] (NO.)	PVC SCREEN[3] (L.F.)	PVC RISER[4] (L.F.)	BENT. PELLET SEAL[5] (L.F.)	CLAY GROUT[6] (L.F.)	PROTECTIVE WELL CASING	55-GALLON DRUMS	WELL DEVEL. (HRS)[7]
Landfills	18	8	26	4	1,130	84	155	300	630	150	470	30	60	60
Coal Storage Areas	8	--	1	--	25	12	--	10	15	5	3	1	2	12
Underground Storage Tanks	6	--	3	--	75	36	--	30	45	15	9	3	6	36
Vehicle and Equipment Storage Areas	20	8(5-ft)	1	--	65	12	--	10	15	5	43	1	5	12
Yard Areas	9	1	4	--	125	36	25	40	60	20	37	4	7	48
Nike Missile Site	2	--	1	--	25	12	--	10	15	5	3	1	2	12

NOTES:

1 Shallow soil borings estimated at 25 feet below ground surface; deeper borings at 70 feet.
2 One boring per site to be sampled continuously; all others sampled at 5-foot intervals.
3 Well screen length estimated at 10 feet.
4 Length of PVC riser includes 2 feet of stickup.
5 Due to shallow water table, assume 2-foot bentonite pellet seal. If conditions permit, a 5-foot bentonite pellet seal will be used.
6 Soil borings will be completely grouted to surface upon completion; wells will be grouted above the bentonite pellet seal.

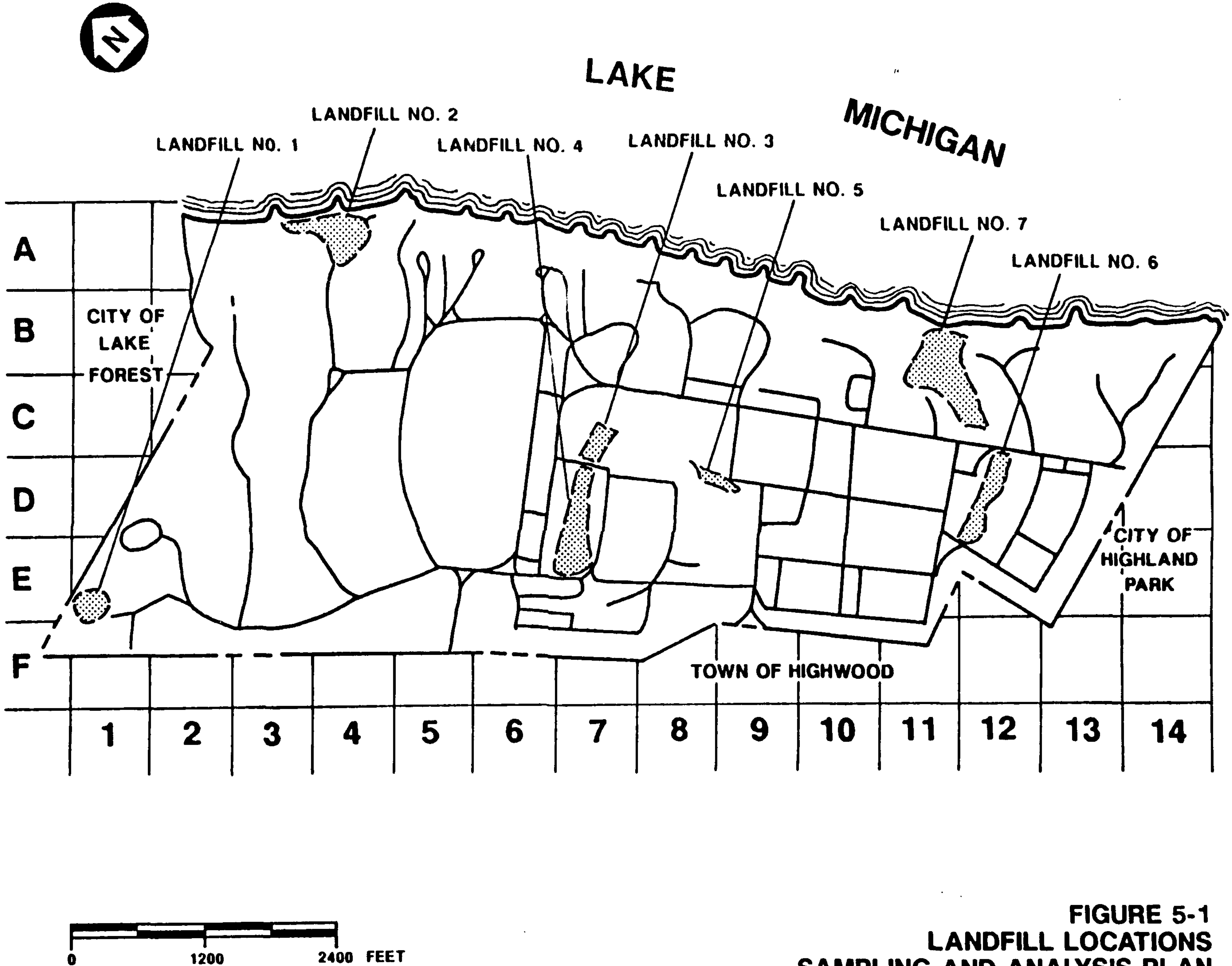

FIGURE 5-1
LANDFILL LOCATIONS
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

6075-04

TABLE 5-2
BACKHOE, DRILLING AND MONITORING WELL SUMMARY
FOR LANDFILLS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

EXPLORATION/SITE	NO. OF EXPLORATIONS		TOTAL DEPTH OF EXPLORATIONS (L.F.)	DEPTH TO GWT (FT.)	NO. OF SPLIT-SPOON SAMPLES		PVC SCREEN (L.F.)	PVC RISER (L.F.)	BENT. PELLET SEAL (L.F.)	CLAY GROUT (L.F.)	PROTECTIVE WELL CASING	55-GALLON DRUMS	WELL DEVEL. (HRS)
					CONT. (NO.)	5-FOOT (NO.)							
Test Pits													
Landfill No. 1	4		60	15	--	--	--	--	--	--	--	--	--
2	8		120	15	--	--	--	--	--	--	--	--	--
3	--		--	--	--	--	--	--	--	--	--	--	--
4	--		--	--	--	--	--	--	--	--	--	--	--
5	--		--	--	--	--	--	--	--	--	--	--	--
6	6		90	15	--	--	--	--	--	--	--	--	--
7	--		--	--	--	--	--	--	--	--	--	--	--
Soil Borings (Shallow)													
Landfill No. 1	--		--	--	--	--	--	--	--	--	--	--	--
2	--		--	--	--	--	--	--	--	--	--	--	--
3	1		25	15	--	5	--	--	--	25	--	--	--
4	3		75	15	--	15	--	--	--	75	--	--	--
5	3		75	15	--	15	--	--	--	75	--	--	--
6	1		25	15	--	5	--	--	--	25	--	--	--
7	--		--	--	--	--	--	--	--	--	--	--	--
Soil Borings with Monitoring Wells	SHALLOW	DEEP											
Landfill No. 1	6	1	220	15	12	40	70	150	35	66	1	14	84
2	8	--	200	15	12	35	80	120	40	24	1	12	96
3	3	--	75	15	12	15	30	45	15	9	1	5	36
4	1	--	25	15	12	--	10	15	5	3	1	2	12
5	2	1	120	15	12	20	30	90	15	54	1	8	36
6	2	1	120	15	12	20	30	90	15	54	1	8	36
7	4	1	170	15	12	30	50	120	25	60	1	11	60

TABLE 5-3
SUMMARY OF ANALYTICAL SAMPLING PROGRAM FOR LANDFILL AREAS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

SITE AND EXPLORATION TYPE	NUMBER OF EXPLORATIONS	MEDIA	NUMBER OF SAMPLES – TCL ANALYTICAL SERIES: VOC	SVOC	ELEMENTS	PESTICIDES/PCBs	HERBICIDES	CLASSICALS	ASBESTOS	NITRO AROMATICS
Landfill No. 1										
Test Pits	4	Soil	8	8	8	8	8	--	1	--
Borings	7	Soil	20	20	20	20	20	--	--	--
Monitoring Wells	7	Water	7	7	7	7	7	7	--	--
Landfill No. 2										
Test Pits	8	Soil	16	16	16	16	16	--	1	16
Borings	8	Soil	22	22	22	22	22	--	--	22
Monitoring Wells	8	Water	8	8	8	8	8	8	--	8
Landfill No. 3										
Test Pits	--	Soil	--	--	--	--	--	--	--	--
Borings	4	Soil	11	11	11	11	11	--	1	--
Monitoring Wells	3	Water	3	3	3	3	3	3	--	--
Landfill No. 4										
Test Pits	--	Soil	--	--	--	--	--	--	--	--
Borings	4	Soil	11	11	11	11	11	--	1	--
Monitoring Wells	1	Water	1	1	1	1	1	1	--	--
Landfill No. 5										
Test Pits	--	--	--	--	--	--	--	--	--	--
Borings	6	Soil	17	17	17	17	17	--	1	--
Monitoring Wells	3	Water	3	3	3	3	3	3	--	--
Landfill No. 6										
Test Pits	6	Soil	12	12	12	12	12	--	--	--
Borings	4	Soil	11	11	11	11	11	--	1	--
Monitoring Wells	3	Water	3	3	3	3	3	3	--	--
Landfill No. 7										
Borings	5	Soil	15	15	15	15	15	--	--	--
Monitoring Wells	5	Water	8	8	8	8	8	8	--	--
Total Soils Samples			143	143	143	143	143	--	6	38
Total Water Samples			33	33	33	33	33	33	--	8

NOTE: The sampling and analytical program for Fort Sheridan will also include the following QA/QC samples: 1 trip blank for VOCs per shipping cooler (estimated total of 12); 1 sampler blank per water sampling event (estimated total of 2 events); and 1 split-spoon sampler blank per event (estimated total of 5 events).

(EPIC) observed the presence of a trench and smoke at this site in a 1952 aerial photograph. However, no activity was noted in 1962 nor in later photographs.

A paved parking lot and possibly segments of Buildings 900 and 902 now cover the site of Landfill No. 1. No visual evidence of its existence remains. A storm sewer crosses the landfill site and discharges to a branch of Janes Ravine south of the landfill. Stormwater runoff from the parking lot is collected in catch basins and rerouted to a branch of Janes Ravine to the south. Unpaved areas above the estimated landfill location slope gently to the northeast.

5.1.1.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize surface and subsurface soil contamination within the landfill area
- investigate upgradient and downgradient shallow groundwater quality
- investigate the hydraulic properties of shallow and deep soils through in-situ permeability tests and visual observation of fissures within the till
- characterize deep groundwater and soil quality in an area downgradient of the landfill

5.1.1.3 Exploration and Sampling Program. The following paragraphs outline the investigation program proposed to meet the technical objectives listed in Subsection 5.1.1.2. Figure 5-2 shows exploration locations at Landfill No. 1.

Geophysical Survey. Geophysical surveys using magnetometer and terrain conductivity instruments will be conducted to evaluate the horizontal extent of landfilled material, to aid in the selection of test pit, soil boring, and monitoring well locations. The area to be surveyed is shown in Figure 5-2. If the pilot magnetometer survey at Landfill No. 7 does not provide useful data concerning the boundary of Landfill No. 7, a magnetometer survey may be omitted at this landfill.

Test Pit Program. A minimum of four test pits will be dug in unpaved areas located to the northeast and southeast of the paved lot at former Landfill No. 1. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on visual observation from the edge of the pit, and materials excavated from the test pit. An average of two analytical soil samples per test pit will be collected from the center of the backhoe bucket using a stainless steel spoon. The soil samples will be analyzed for TCL VOCs, SVOCs, elements, pesticides/PCBs, and herbicides. One sample of material containing building debris at Landfill No. 1 will be analyzed for asbestos.

Soil Boring Program. A total of seven soil borings will be installed at Landfill No. 1. (The boundary of the geophysical survey shown in Figure 5-2 approximates the interpreted landfill boundary, and is based on a review of

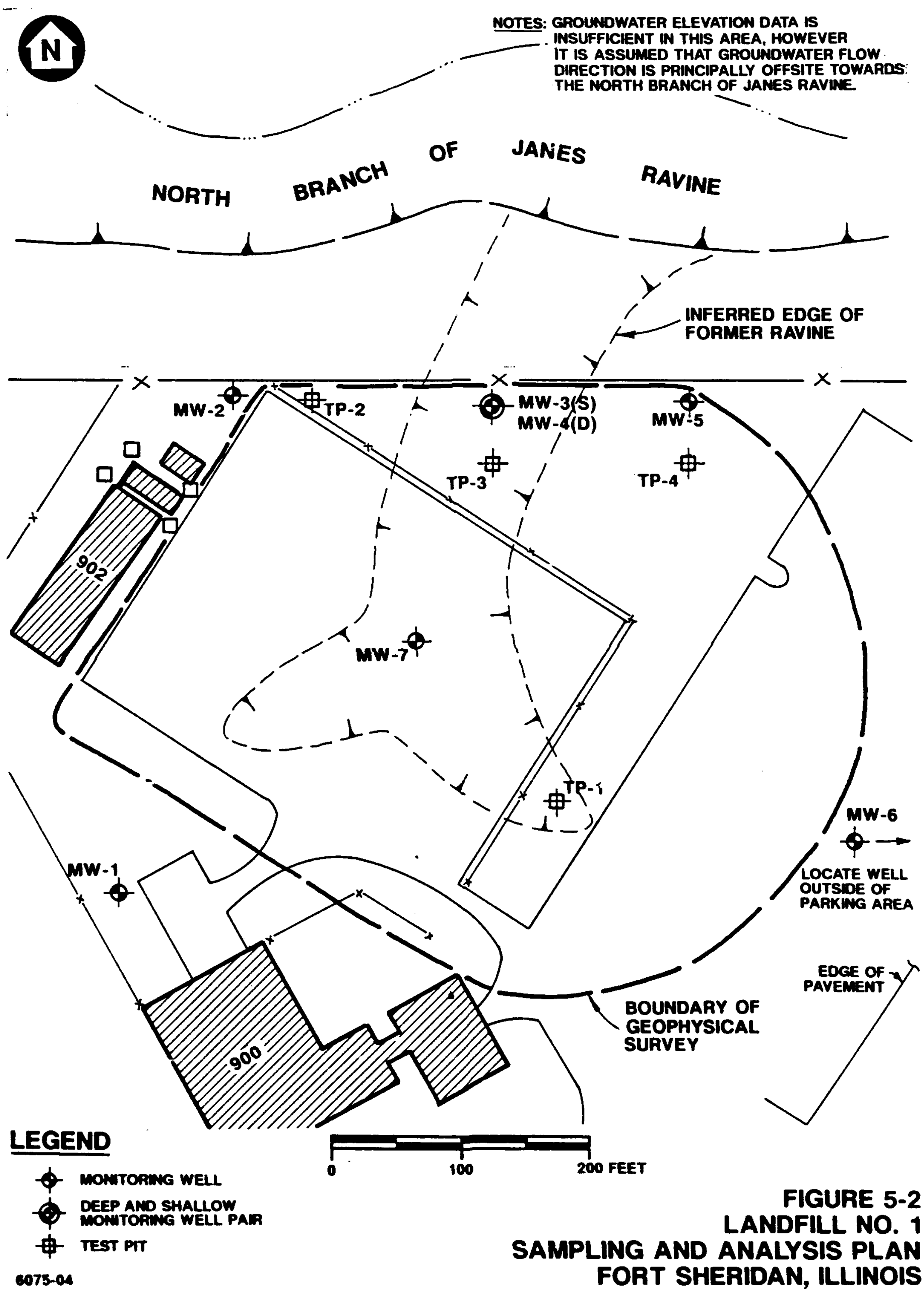

FIGURE 5-2
LANDFILL NO. 1
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

historical aerial photographs and post maps.) One of the borings will be positioned upgradient of the landfill. One boring will be located within the area interpreted to have been a former ravine tributary to the northern branch of the Janes Ravine. Four borings will be placed downgradient of the landfill, along the post boundary, and the seventh boring will be located southeast of Landfill No. 1, towards the primary branch of Janes Ravine.

All of the borings except the central downgradient boring will be completed as shallow borings, and are estimated to be 25 feet in depth, approximately 10 feet below the water table. The one downgradient deep boring is estimated to be approximately 70 feet in depth, and is designed to investigate deep silt lenses, if present, which were noted elsewhere at Fort Sheridan at elevation 600. At least one of the downgradient borings will be sampled continuously, using a split-spoon sampler. The other borings will be sampled at a maximum of 5-foot intervals or more frequently at stratigraphic changes. Soil samples will be screened in the field using a portable photoionization detector (PID). Based on the field screening results, two soil samples from the upgradient boring and an average of three soil samples from each of the remaining borings will be submitted for laboratory analysis. The soil samples from Landfill No. 1 will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, elements, and herbicides.

<u>Monitoring Well Installation</u>. A 4-inch ID monitoring well will be installed in each of the boreholes upon completion. The monitoring wells will be constructed of Schedule 40, flush-joint, threaded PVC pipes. The screens will be positioned to extend from approximately 2 feet above the water table to 8 feet below. The annulus around the well screen and at least 5 feet above the top of the screen, will be backfilled with clean silica sand. A minimum 5-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be equipped with a 5-foot-long steel protective casing with lock which extends approximately 2.5 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

Upon completion, monitoring wells will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, wells will be developed using block and surge techniques. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the wells will be developed by purging five well volumes or an alternate method approved by USATHAMA.

In-situ permeability tests will be conducted in a minimum of one well per site to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

One round of groundwater samples will be collected from each well at this site. Sampling will not occur sooner than 14 days following well development or permeability testing. The groundwater samples will be analyzed for TCL VOCs, SVOCs, elements, pesticides/PCBs, herbicides, and classical pollutants.

If analytical data from scheduled sampling of Well MW-7 at Landfill No. 1 indicates contamination above applicable groundwater standards, the well will be closed by backfilling with a 20:1 cement-bentonite grout as described in Section 3.2.

5.1.2 Landfill No. 2

5.1.2.1 Site Description. Landfill No. 2 is located in a branch of Hutchinson Ravine in the northeastern part of Fort Sheridan. The Initial Installation Assessment (IIA) indicates that the site was used prior to World War I (Gross et al., 1982). At that time, a small arms firing range was constructed over it and used until the 1950s. The exact dates and type of refuse disposed of at the site are uncertain; however, excavation activities in the area have uncovered coal and cinders. The IIA also reports that the 51st Explosive Ordnance Detachment disposed of ammunition at this site by blowing it up in a pit dug for that purpose (Gross et al., 1982). Although EPIC reported that the area contained disturbed ground in 1952, it appeared inactive and vegetated in 1962. However, extensive activity was noted in 1967 and 1972 photographs; no activity was observed in 1976 and 1985 photographs. Numerous surface mounds give the appearance that the final fill material was never bulldozed to a final grade. There is no storm drain associated with this site.

5.1.2.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- surface sweep the landfill and clear of all surface ordnance or explosives
- characterize surface and subsurface soil contamination within the landfill area
- investigate upgradient and downgradient shallow groundwater quality
- investigate the hydraulic properties of shallow soils through in-situ permeability tests and visual observation of fissures within the till
- delineate the lateral extent of the landfill

5.1.2.3 Exploration and Sampling Program. The following paragraphs outline the investigation program proposed to meet the technical objectives listed in Subsection 5.1.2.2. Figure 5-3 shows the exploration locations at Landfill No. 2.

UXO Sweeping and Clearance. A USATHAMA approved UXO/EOD contractor will surface sweep and clear the area of Landfill No. 2 of surface ordnance or explosives using a MK-26 Ordnance Locator prior to surface geophysics, test pitting, or drilling activities. It is not an RI goal to locate and render safe all buried UXO at Landfill No. 2.

During soil boring where UXO are suspected, the drill bit will be retracted at 2 ft. to 4 ft. intervals according to the judgement of the UXO technician, who

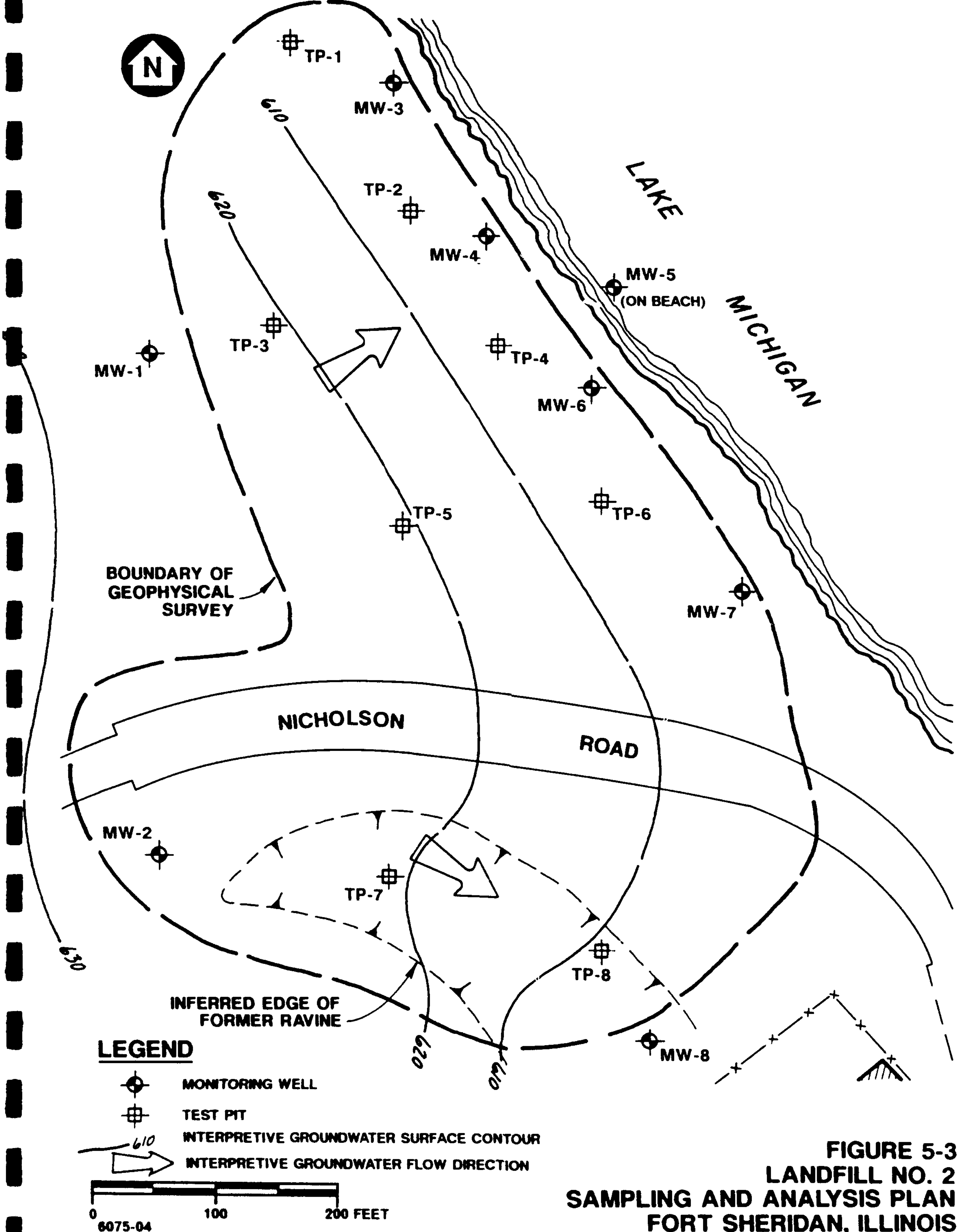

FIGURE 5-3
LANDFILL NO. 2
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

will search ahead of the drill bit for metallic contacts using a MK-26 Ordnance Locator. If suspicious contact is discovered, the site will be abandoned and moved at least 10 feet. Search will continue until the drill has reached at least 25 feet in depth.

During test pitting where UXO are suspected, the UXO technician, using a MK-26 Ordnance Locator, will search ahead of the backhoe bucket at 2 to 4 ft. intervals. If UXO are encountered, the UXO contractor will mark the items location and contact the 51st U.S. Army EOD Unit at Fort Sheridan and arrange for the item to be removed or rendered safe.

The location of all identified or suspected UXOs will be marked, and reported to the 51st U.S. Army EOD Unit. The UXO/EOD contractor will assist in developing a "render safe" plan for all UXO.

Test pitting and soil boring activities in areas where UXO are suspected will be supervised by the UXO/EOD contractor.

Appendix A contains a General Contract Statement prepared by USATHAMA for Unexploded Ordnance Contractor Support. The General Contract Statement provides greater detail of the qualifications and work requirements for a UXO contractor.

Geophysical Survey. Geophysical surveys using magnetometer and terrain conductivity instruments will be conducted to evaluate the horizontal extent of landfilled material, to aid in the selection of test pit, soil boring, and monitoring well locations. The area to be surveyed is shown in Figure 5-3. If the pilot magnetometer survey at Landfill No. 7 does not provide useful data concerning the boundary of Landfill No. 7, a magnetometer survey may be omitted at this landfill.

Test Pit Program. A minimum of eight test pits will be dug in former Landfill No. 2. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on materials excavated from the test pit using a backhoe and visual observations from the edge of the pit. An average of two soil samples per test pit will be submitted for laboratory analysis. The soil samples will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, elements, and herbicides. Analysis will also be conducted for nitroaromatic compounds by HPLC. One sample of material containing building debris at Landfill No. 2 will be analyzed for asbestos.

Soil Boring Program. A total of eight soil borings will be installed at Landfill No. 2. Groundwater flow direction from the area of Landfill No. 2, which is north of Nicholson Road, is anticipated to be to the east towards Lake Michigan. Groundwater flow south of Nicholson Road is anticipated to be to the south, towards the western branch of Hutchinson Ravine as shown in Figure 5-3. Because of the large area covered by Landfill No. 2 and the differing flow directions, two of the borings, B-1 and B-2, will be positioned upgradient of the landfill. The geophysical survey boundary shown on Figure 5-3 approximates the interpreted landfill area and is based on a review of the historical aerial photographs. The remaining six borings will be located along the eastern and southern downgradient boundaries. B-4 through B-8 will be located along the top

of the bluff, at the edge of the woods; B-3 will be located at the mouth of the ravine, near the current water treatment plant. All of the borings will be completed as shallow borings, and are estimated to be 25 feet in depth, approximately 10 feet below the water table.

At least one of the downgradient borings will be sampled continuously, using a split-spoon sampler. The other borings will be sampled at 5-foot intervals or more frequently at stratigraphic changes. Soil samples will be screened in the field using a PID. Based on the field screening results, two soil samples from each of the upgradient borings (B-1 and B-2) and an average of three soil samples from each of the remaining borings will be submitted for laboratory analysis. The soil samples from Landfill No. 2 will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, elements, and herbicides.

Monitoring Well Installation. A 4-inch ID monitoring well will be installed in each of the boreholes upon completion. The monitoring wells will be constructed of Schedule 40, flush-joint, threaded PVC pipes. The screens will be positioned to extend from approximately 2 feet above the water table to 8 feet below. The annulus around the well screen and at least 5 feet above the top of the screen will be backfilled with clean silica sand. A minimum 5-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be equipped with a 5-foot-long steel protective casing with lock which extends approximately 2.5 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

Upon completion, monitoring wells will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, wells will be developed using a surge block. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the wells will be developed by purging five well volumes or an alternate method approved by USATHAMA.

In-situ permeability tests will be conducted in a minimum of one well per site to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

One round of groundwater samples will be collected from each well at this site. Sampling will not occur sooner than 14 days following well development or permeability testing. Groundwater samples will be analyzed for TCL VOCs, SVOCs, elements, pesticides/PCBs, herbicides, and classical pollutants. Analysis will also be conducted for nitroaromatic compounds by HPLC.

5.1.3 Landfills Nos. 3 and 4

5.1.3.1 Site Description. Landfill No. 3 is believed to be under a paved parking area between Ronan Road and an unfilled segment of Bartlett Ravine to the east. The pavement is nearly level, but does slope gently to the east. Gross reports that the landfill operated prior to 1947 and received general industrial and domestic refuse (Gross et al., 1982). Open burning was practiced

at this site. Available information does not indicate that hazardous wastes were disposed of at this site; however, POL and other potentially hazardous items could have been placed there. A 48-inch storm drain underlies Landfill No. 3.

Landfill No. 4 is located in the northern branch of Bartlett Ravine west of Landfill No. 3, extending from Ronan Road to Lyster Road. The western part of Landfill No. 4 lies under a grassed area, while the eastern part is believed to extend beneath a paved parking lot, ending at Ronan Road. The entire site slopes gently toward the east. EPIC reports that Landfill No. 4 was active in 1967, but not in 1962 or 1972. Available information indicates that construction rubble was the only material disposed of at this location (Argonne National Laboratory, 1989). A 36-inch storm sewer that transports surface drainage from Fort Sheridan and possibly from the Town of Highwood underlies Landfill No. 4. The diameter of this storm sewer increases to 48-inches under Landfill No. 3.

5.1.3.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize surface and subsurface soil contamination within the landfill areas
- investigate upgradient and downgradient shallow groundwater quality
- investigate the hydraulic properties of shallow soils through in-situ permeability tests, visual observation of fissures within the till, and water level measurements
- characterize deep soil and groundwater quality in an area downgradient of Landfill No. 4
- delineate the landfill boundary

5.1.3.3 Exploration and Sampling Program. The following paragraphs outline the investigation program proposed to meet the technical objectives listed in Section 5.1.3.2. Figure 5-4 shows the exploration locations at Landfill Nos. 3 and 4.

Geophysical Survey. Geophysical surveys using magnetometer and terrain conductivity instruments will be conducted at each landfill to evaluate the horizontal extent of landfilled material, to aid in the selection of test pit, soil boring, and monitoring well locations. The areas to be surveyed are shown in Figure 5-4. If the pilot magnetometer survey at Landfill No. 7 does not provide useful data concerning the boundary of Landfill No. 7, a magnetometer survey may be omitted at these landfills.

Soil Boring Program. A total of eight soil borings will be installed at Landfill Nos. 3 and 4. Groundwater flow directions in this area are anticipated to be to the east, along the former branch of Bartlett Ravine. B-1 will be positioned upgradient of both landfills. (The boundary of the geophysical

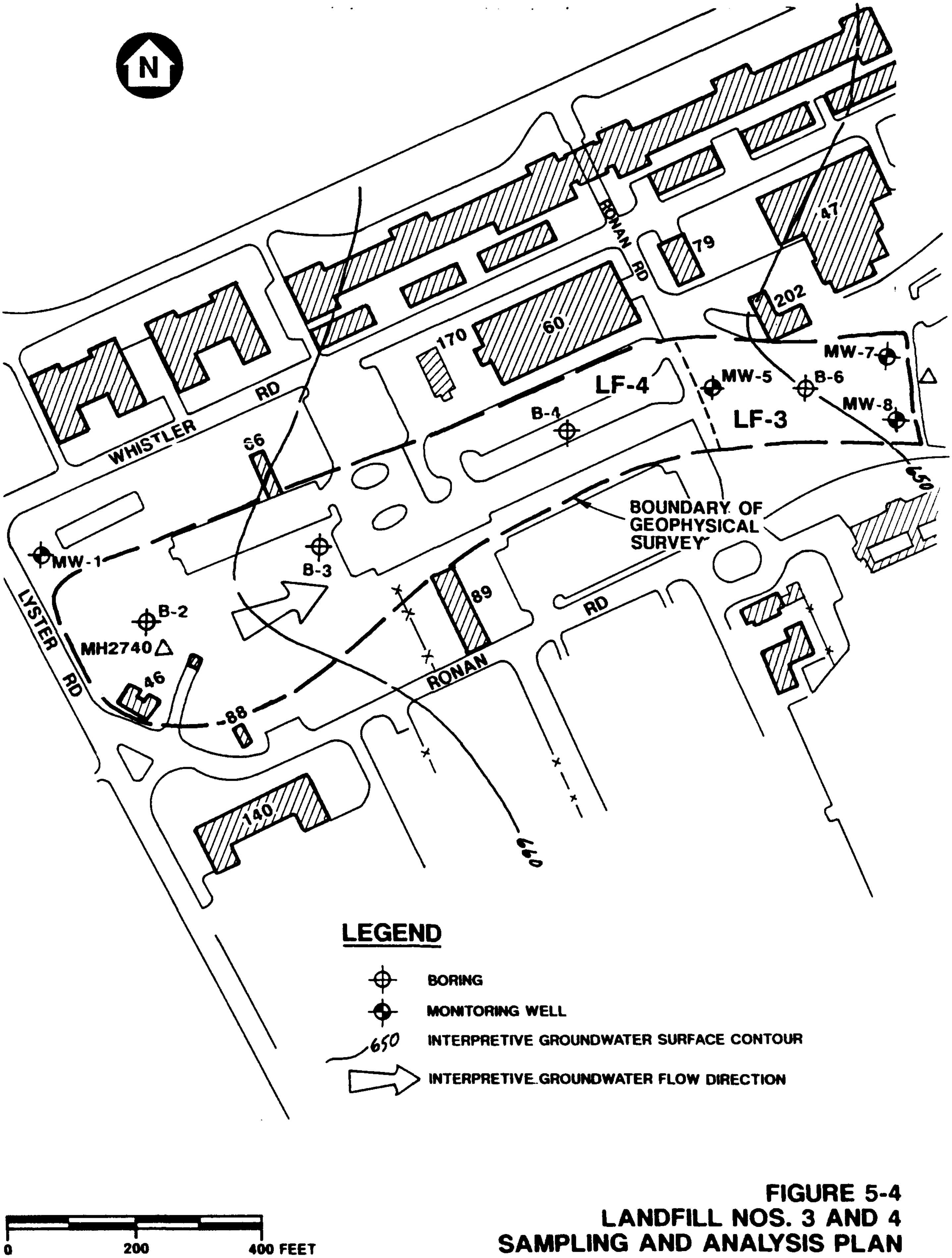

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FIGURE 5-4
LANDFILL NOS. 3 AND 4
SAMPLING AND ANALYSIS PLAN
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survey shown in Figure 5-4 approximates the interpreted landfill boundary, and is based on a review of historical aerial photographs and post maps.) B-5, which will be equipped with a monitoring well, serves as a downgradient boring for Landfill No. 4, and an upgradient boring for Landfill No. 3. Borings B-7 and B-8 will be located downgradient of both landfills, at the edge of the parking lot, and adjacent to the existing Bartlett Ravine. Five borings will be located within the former landfill areas. All of the borings will be completed as shallow borings, and are estimated to be 25 feet in depth, approximately 10 feet below the water table.

At least one of the downgradient borings will be sampled continuously, using a split-spoon sampler. The other borings will be sampled at 5-foot intervals or more frequently at stratigraphic changes. Soil samples will be screened in the field using a PID instrument. Based on the field screening results, two soil samples from the upgradient boring (B-1) and an average of three soil samples from the each of the remaining borings will be submitted for laboratory analysis. The soil samples from Landfills No. 3 and 4 will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, elements, and herbicides. A total of two samples of material containing building debris at Landfill Nos. 3 and 4 will be analyzed for asbestos.

<u>Monitoring Well Installation</u>. A 4-inch ID monitoring well will be installed in four of the boreholes upon completion. The monitoring wells will be constructed of Schedule 40, flush-joint, threaded PVC pipes. The screens will be positioned to extend from approximately 2 feet above the water table to 8 feet below. The annulus around the wellscreen and at least 5 feet above the top of the screen, will be backfilled with clean silica sand. A minimum 5-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be equipped with a 5-foot-long steel protective casing with lock which extends approximately 2.5 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

Upon completion, monitoring wells will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, wells will be developed using a surge block. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the wells will be developed by purging five well volumes or an alternate method approved by USATHAMA.

In-situ permeability tests will be conducted in a minimum of one well per site to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

One round of groundwater samples will be collected from each well at this site. Sampling will not occur sooner than 14 days following well development or permeability testing. Groundwater samples will be analyzed for TCL VOCs, SVOCs, elements, pesticides/PCBs, herbicides, and classical pollutants.

5.1.4 Landfill No. 5

5.1.4.1 Site Description. Landfill No. 5 is located in the southern branch of Bartlett Ravine west of Buildings 162 and 378. It underlies a paved parking area that slopes gently to the northeast toward Bartlett Ravine. Excavations have uncovered cinders and other burned refuse, along with artifacts dating to the early 1900s. A location used for the disposal of construction rubble in the mid-1960s is visible in a 1967 aerial photograph in an area west of Building 162.

Elevation contours on a 1924 post map suggest that the filled area may extend from the current edge of Bartlett Ravine to and possibly across Finley Road. The exact dates and types of refuse are uncertain. Aerial photographs indicate the area has been used as an open vehicle and equipment storage area since at least 1952. A 15-inch storm sewer underlies Landfill No. 5.

5.1.4.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize surface and subsurface soil contamination within the landfill areas
- investigate upgradient and downgradient shallow groundwater quality
- investigate the hydraulic properties of shallow and deep soils through in-situ permeability tests, visual observation of fissures within the till, and water level measurements
- characterize deep soil and groundwater quality in an area downgradient of Landfill No. 5
- delineate the landfill boundary

5.1.4.3 Exploration and Sampling Program. The following paragraphs outline the investigation program proposed to meet the technical objectives listed in Subsection 5.1.4.2. Figure 5-5 shows the exploration locations at Landfill No. 5.

Geophysical Survey. Geophysical surveys using magnetometer and terrain conductivity instruments will be conducted to evaluate the horizontal extent of landfilled material, to aid in the selection of test pit, soil boring, and monitoring well locations. The area to be surveyed is shown in Figure 5-5. If the pilot magnetometer survey at Landfill No. 7 does not provide useful data concerning the boundary of Landfill No. 7, a magnetometer survey may be omitted at this landfill.

Soil Boring Program. A total of six soil borings will be installed at Landfill No. 5. Groundwater flow directions in this area anticipated to be to the north-northwest, towards Bartlett Ravine. B-1 will be positioned upgradient of the landfill. (The boundary of the geophysical survey shown in Figure 5-5 approximates the interpreted landfill boundary, and is based on a review of

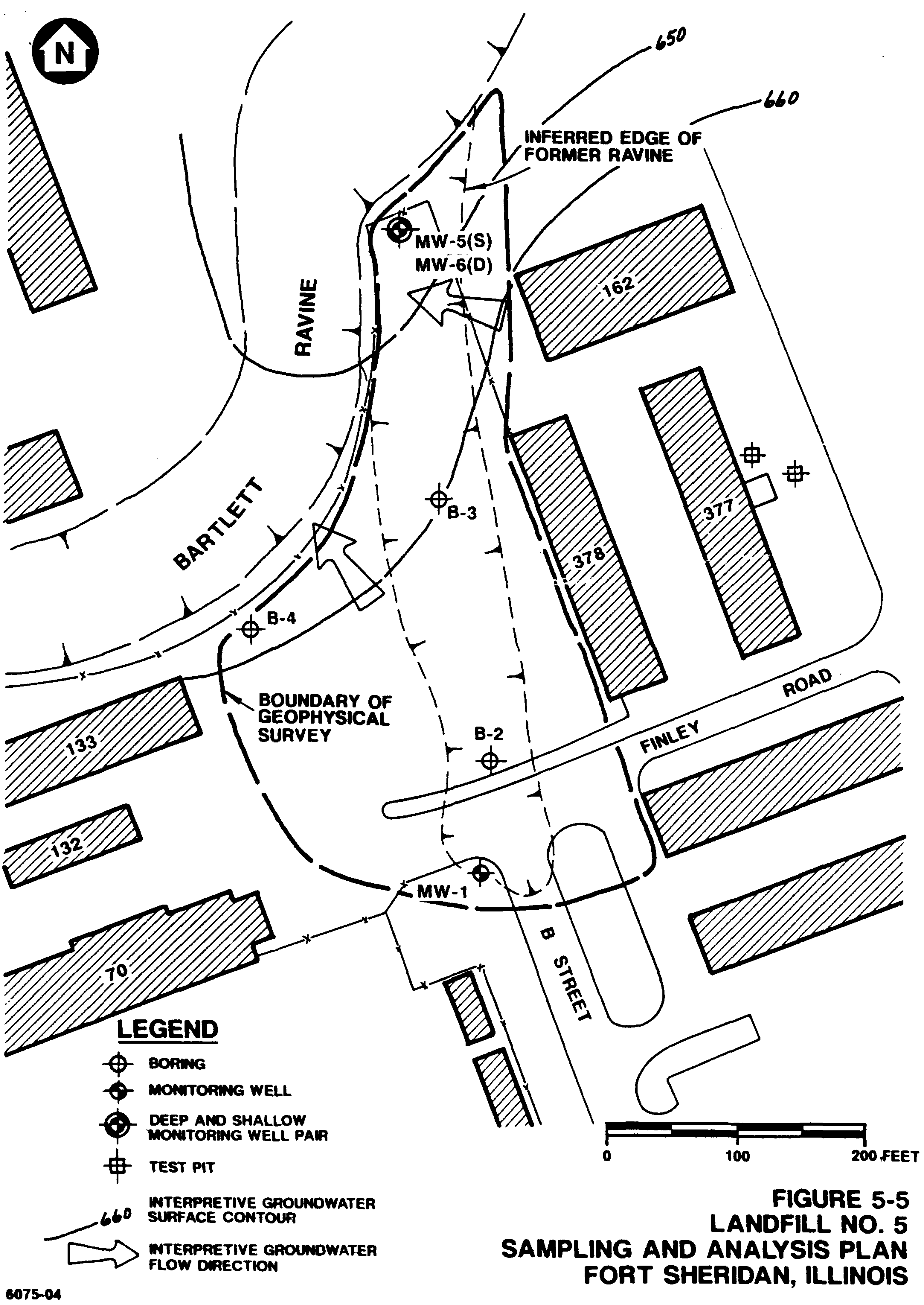

FIGURE 5-5
LANDFILL NO. 5
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

historical aerial photographs and post maps.) Two borings will be located within the former landfill areas. The remaining two borings will be located downgradient of Landfill No. 5, adjacent to the existing Bartlett Ravine. All but one of the borings will be completed as shallow borings, and are estimated to be 25 feet in depth, approximately 10 feet below the water table. One downgradient boring will be completed as a deep boring, estimated to be 70 feet in depth to intercept deep silt lenses, if present. These lenses were noted elsewhere at Fort Sheridan at elevation 600.

At least one of the shallow downgradient borings will be sampled continuously, using a split-spoon sampler. The other borings will be sampled at 5-foot intervals or more frequently at stratigraphic changes. Soil samples will be screened in the field using a PID. Based on the field screening results, two soil samples from the upgradient boring (B-1), and an average of three soil samples from each of the remaining borings will be submitted for laboratory analysis. The soil samples from Landfill No. 5 will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, elements, and herbicides. One sample of material containing building debris at Landfill No. 5 will be analyzed for asbestos.

Monitoring Well Installation. A 4-inch ID monitoring well will be installed in three of the boreholes upon completion. The monitoring wells will be constructed of Schedule 40, flush-joint, threaded polyvinyl chloride (PVC) pipes. The screens will be positioned to extend from approximately 2 feet above the water table to 8 feet below. The annulus around the wellscreen and at least 5 feet above the top of the screen, will be backfilled with clean silica sand. A minimum 5-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be equipped with a 5-foot-long steel protective casing with lock which extends approximately 2.5 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

Upon completion, monitoring wells will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, wells will be developed using block and surge techniques. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the wells will be developed by purging five well volumes or an alternate method approved by USATHAMA.

In-situ permeability tests will be conducted in a minimum of one well per site to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

One round of groundwater samples days will be collected from each well at this site. Sampling will not occur sooner than 14 days following well development or permeability testing. Groundwater samples will be analyzed for TCL VOCs, SVOCs, elements, pesticides/PCBs, herbicides, and classical pollutants.

5.1.5 Landfill No. 6

Landfill Nos. 6 and 7 are located within the same branch of Wells Ravine; however, due to the large size and previous investigations at Landfill No. 7, the programs for the two landfills are discussed separately in the following sections.

5.1.5.1 Site Description. Landfill No. 6 is located in Wells Ravine west of Patten Road. Industrial and domestic wastes were reportedly dumped at this site, as well as debris generated from the demolition of several World War II barracks in the 1960s. Although the available information does not indicate the disposal of hazardous wastes at this site, some POL and solvents were probably disposed of at this location (Bonds, 1987).

Landfill No. 6 is now covered with soil that has an established grass growth in some areas. Other areas are graveled or unvegetated. The ground surface has been contoured to receive surface runoff from the surrounding area and to direct it east toward Patten Road. It is likely that the drainage path follows the contour of Wells Ravine before filling. The area appears to have a high groundwater table.

A 36-inch storm sewer that transports stormwater from the Town of Highwood and Fort Sheridan areas passes under Landfill No. 6.

5.1.5.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize surface and subsurface soil contamination within the landfill
- investigate upgradient and downgradient shallow groundwater quality
- investigate the hydraulic properties of shallow and deep soils through in-situ permeability tests, visual observation of fissures within the till, and water level measurements
- characterize deep soil and groundwater quality in an area downgradient of Landfill No. 6
- delineate the landfill boundary

5.1.5.3 Exploration and Sampling Program. The following paragraphs outline the investigation program proposed to meet the technical objectives listed in Subsection 5.1.5.2. Figure 5-6 shows the exploration locations at Landfill No. 6.

Geophysical Survey. Geophysical surveys using magnetometer and terrain conductivity instruments will be conducted to evaluate the horizontal extent of landfilled material, to aid in the selection of test pit, soil boring, and monitoring well locations. The area to be surveyed is shown in Figure 5-6. If the pilot magnetometer survey at Landfill No. 7 does not provide useful data

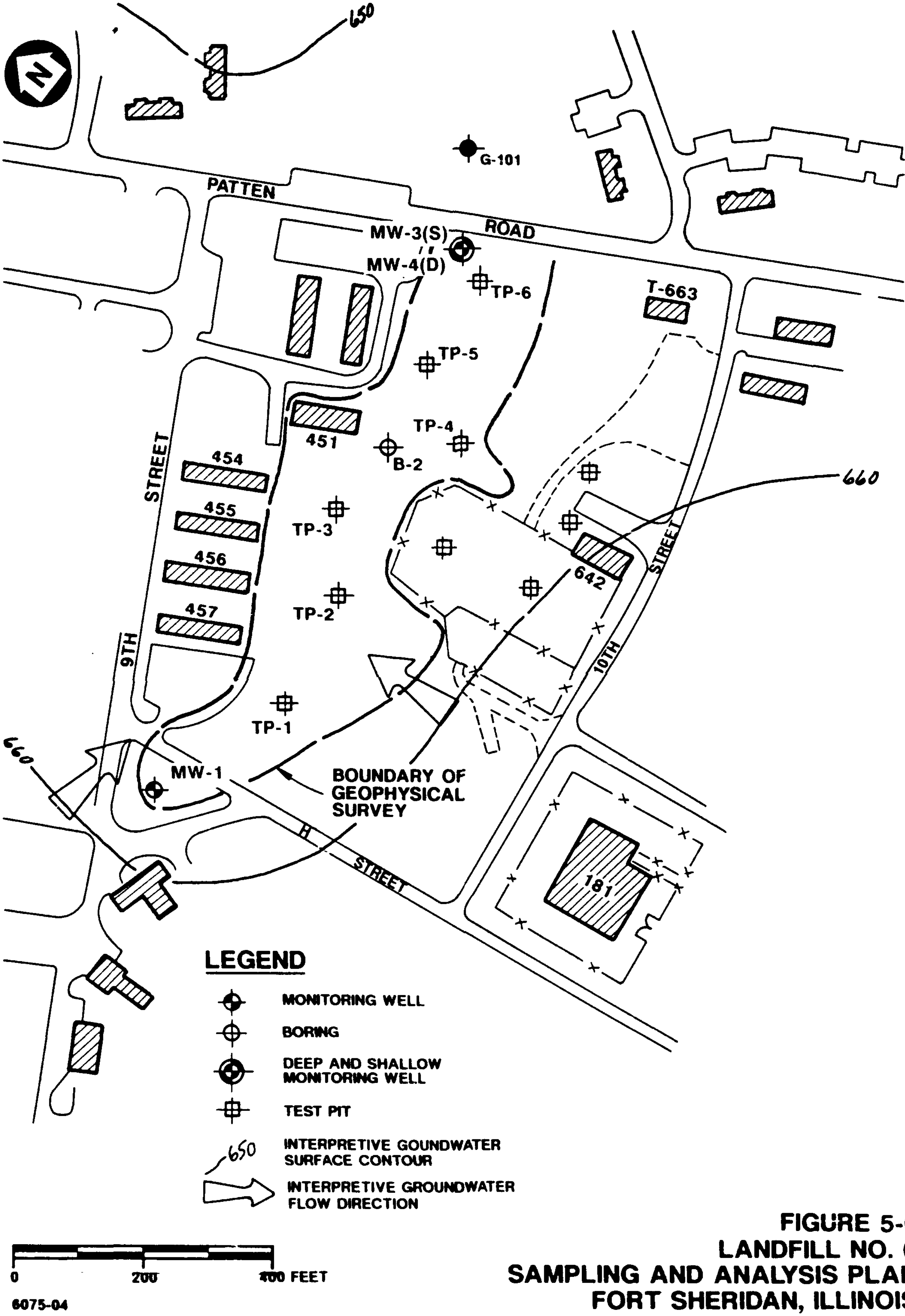

FIGURE 5-6
LANDFILL NO. 6
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

concerning the boundary of Landfill No. 7, a magnetometer survey may be omitted at this landfill.

Test Pit Program. A minimum of six test pits will be dug in former Landfill No. 6. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on materials excavated from the test pit using a backhoe, and visual observations from the edge of the test pit. An average of two analytical soil samples per test pit will be collected from the center of the backhoe bucket using a stainless steel spoon. The soil samples will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, elements, and herbicides. One sample of material containing building debris at Landfill No. 6 will be analyzed for asbestos.

Soil Boring Program. A total of four soil borings will be installed at Landfill No. 6. Groundwater flow in this area is anticipated to be to the northeast, towards Lake Michigan. B-1 will be positioned upgradient of the landfill. (The boundary of the geophysical survey shown in Figure 5-6 approximates the interpreted landfill boundary, and is based on a review of historical aerial photographs and post maps.) One boring (B-2) will be located within the former landfill area. B-3 and B-4, which will be equipped with monitoring wells, will be shallow and deep downgradient borings, respectively, for Landfill No. 6, and upgradient wells for Landfill No. 7. All of the borings except B-4 will be completed as shallow borings, and are estimated to be 25 feet in depth, approximately 10 feet below the water table. B-4 will be a deep soil boring and is estimated to be 70 feet in depth.

The downgradient shallow boring will be sampled continuously, using a split-spoon sampler. The other borings will be sampled at 5-foot intervals or more frequently at stratigraphic changes. Soil samples will be screened in the field using PID. Based on the field screening results, two soil samples from the upgradient boring, and an average of three soil samples from each of the other borings will be submitted for laboratory analysis. The soil samples from Landfill No. 6 will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, elements, and herbicides.

Monitoring Well Installation. A 4-inch ID monitoring well will be installed in three of the boreholes upon completion. The monitoring wells will be constructed of Schedule 40, flush-joint threaded PVC pipes. The screens will be positioned to extend from approximately 2 feet above the water table to 8 feet below. The annulus around the wellscreen and at least 5 feet above the top of the screen, will be backfilled with clean silica sand. A minimum 5-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be equipped with a 5-foot-long steel protective casing with lock which extends approximately 2.5 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

Upon completion, monitoring wells will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, wells will be developed using block and surge techniques. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the wells will be developed by purging five well volumes or an alternate method as approved by USATHAMA.

In-situ permeability tests will be conducted in a minimum of one well per site to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

One round of groundwater samples will be collected at this site. Sampling will not occur sooner than 14 days following well development or permeability testing. Groundwater samples will be analyzed for TCL VOCs, SVOCs, elements, pesticides/PCBs, herbicides, and classical pollutants.

5.1.6 Landfill No. 7

5.1.6.1 Site Description. Landfill No. 7, also known as the Wells Ravine Landfill, is located in Wells Ravine east of Patten Road. This area was used as a landfill site in the 1940s and again in the 1960s and 1970s. Disposal operations ceased on July 1, 1979. Fill material at this site included domestic, general, industrial, and hospital wastes (Argonne National Laboratory, 1989). In addition, open burning was practiced at this location before 1970. Coal ash from the heating plant was often used as temporary cover material.

Fort Sheridan is working with Illinois Environmental Protection Agency (IEPA) to obtain approval for closure of Landfill No. 7. Fort Sheridan has installed a domed clay cover over the landfill and a storm drain around the perimeter to collect surface runoff. In addition, a curtain drain with a 6-inch-diameter collection pipe was installed across the face of the landfill to intercept leachate that might otherwise migrate to Lake Michigan. The drainage pipe is designed to discharge to a wet well and be pumped up to the sanitary sewer system for treatment and disposal. Gas vents have also been installed in the landfill to prevent gas buildup.

Observations at the landfill in October 1989 indicated that the landfill was forming gas from bacterial decomposition of wastes. Hydrogen sulfide odors and stained areas were noticeable at several locations around the landfill.

It was also observed that the pump intended to pump leachate from the collection wet well to the sanitary sewer was disconnected. There was little liquid in the wet well, suggesting that little or no leachate was being collected by the curtain drain system. It is possible that leachate from the landfill infiltrates a 42-inch storm drain that underlies the landfill and is discharged to Lake Michigan along with stormwater.

5.1.6.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- investigate upgradient and downgradient shallow and deep groundwater quality
- investigate the hydraulic properties of downgradient shallow and deep soils through in-situ permeabililty tests and visual observation of fissures within the till

- o delineate the landfill boundary

<u>5.1.6.3 Exploration and Sampling Program</u>. The following paragraphs outline the investigation program proposed to meet the technical objectives listed in Subsection 5.1.6.2. Figure 5-7 shows the exploration location for Landfill No. 7.

<u>Geophysical Survey</u>. Magnetometer and terrain conductivity survey will be conducted at Landfill No. 7 to evaluate the horizontal extent of landfilled material, and aid in selection of soil boring and monitoring well locations. The area to be surveyed is shown in Figure 5-7. The magnetometer survey at this site will also serve as a pilot study to evaluate the potential usefulness of this technique at the other landfills.

<u>Soil Boring Program</u>. A total of five soil borings will be installed at Landfill No. 7. Groundwater flow directions in this area are anticipated to be to the northeast, towards Lake Michigan. There are three existing water table wells along the southern edge of Landfill No. 7 which will be used to monitor upgradient (G-101) and downgradient (G-102 and G-104) groundwater quality. Additional wells are needed to investigate soils and water quality along the western (B-1) and northwestern edges (B-2) of the landfill. (The boundary of the geophysical survey shown in Figure 5-7 approximates the interpreted landfill boundary, and is based on a review of historical aerial photographs and post maps.) B-3/B-4 will be a shallow and deep well pair located on the upper terrace at the downgradient edge of the landfill. B-5, located on the beach at the toe of the bluff, in conjunction with B-3, will provide needed hydraulic gradient data. All of the borings except B-4 will be completed as shallow borings, and are estimated to be 25 feet in depth, approximately 10 feet below the water table. B-4 will be a deep soil boring and is estimated to be 70 feet in depth.

The downgradient shallow boring (B-3) will be sampled continuously, using a split-spoon sampler. The other borings will be sampled at 5-foot intervals or more frequently at stratigraphic changes. Soil samples will be screened in the field using a PID. All of the wells to be installed are considered to be downgradient. Therefore, based on the field screening results, an average of three soil samples per boring will be submitted for laboratory analysis. The soil samples from Landfill No. 7 will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, elements, and herbicides.

<u>Monitoring Well Installation</u>. A 4-inch ID monitoring well will be installed in three of the boreholes upon completion. The monitoring wells will be constructed of Schedule 40, flush-joint, threaded polyvinyl chloride (PVC) pipes. The screens will be positioned to extend from approximately 2 feet above the water table to 8 feet below. The annulus around the wellscreen and at least 5 feet above the top of the screen, will be backfilled with clean silica sand. A minimum 5-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be equipped with a 5-foot-long steel protective casing with lock which extends approximately 2.5 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

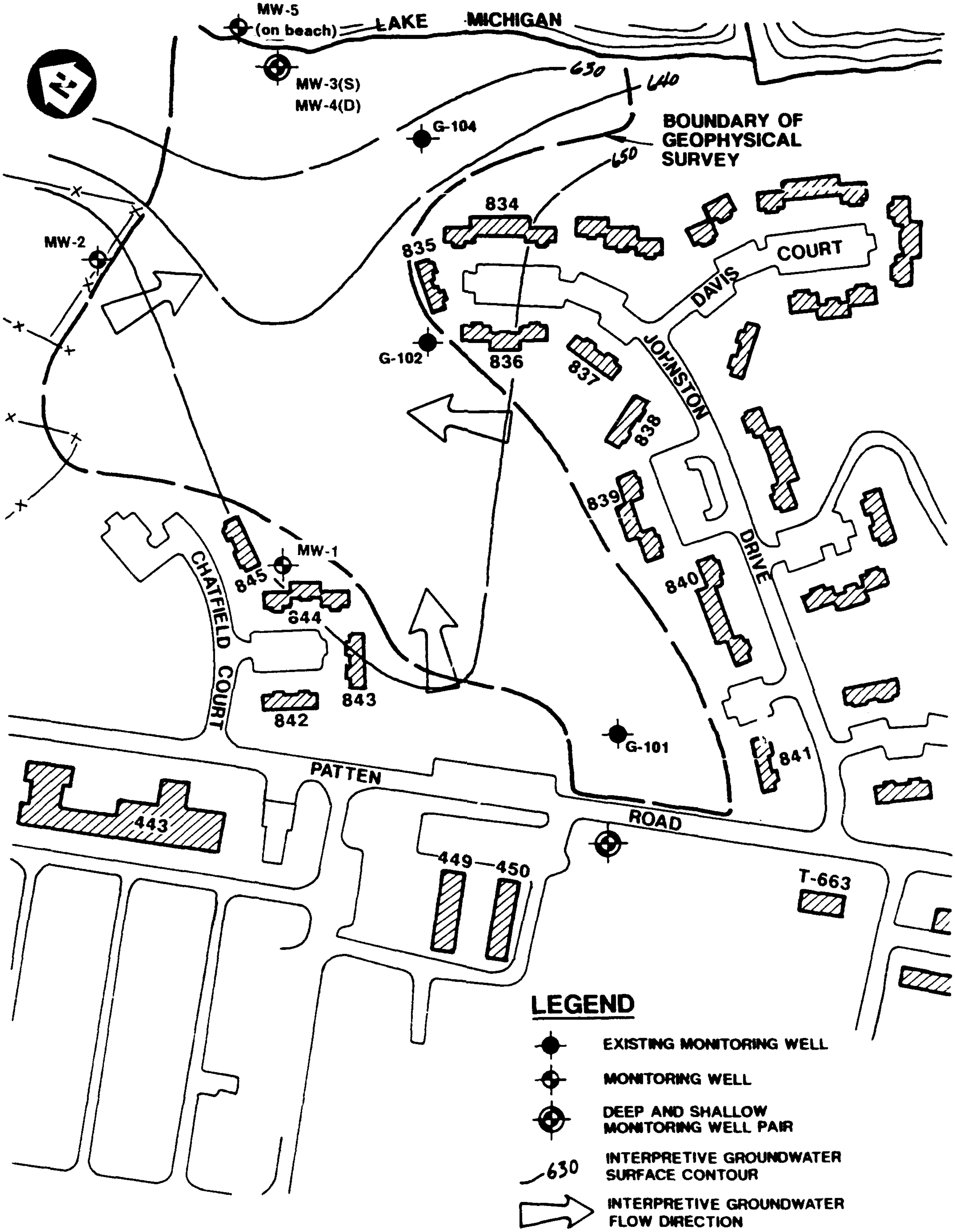

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FIGURE 5-7
LANDFILL NO. 7
SAMPLING AND ANALYSIS PLAN
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Upon completion, monitoring wells will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, wells will be developed using block and surge techniques. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the wells will be developed by purging five well volumes or an alternate method approved by USATHAMA.

In-situ permeability tests will be conducted in a minimum of one well per site to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

One round of groundwater samples will be collected at this site. Samples will be collected from previously existing wells G-101, G-102, and G-104 in addition to the newly installed wells, MW-1 through MW-5. Sampling will not occur sooner than 14 days following well development or permeability testing. Groundwater samples will be analyzed for TCL VOCs, SVOCs, elements, pesticides/PCBs, herbicides, and classical pollutants.

5.2 COAL STORAGE AREAS

Four areas were identified at Fort Sheridan where coal was stockpiled in uncovered piles directly on the ground surface. The RI programs to be conducted at Coal Storage Areas Nos. 1 through 4 are described in the following sections. Figure 5-8 shows the locations of all of the coal storage sites. Table 5-4 summarizes the exploration programs and Table 5-5 summarizes the sampling and analytical programs for the Coal Storage Areas.

5.2.1 Coal Storage Area No. 1

5.2.1.1 Site Description. This is a roughly triangular parcel of approximately 1 acre located between railroad sidings north of Building 137X and east of Building 115. This area is now mostly grassed, although a portion of it behind Building 137X is fenced, graveled, and used for equipment parking and storage. The soil underlying the grassed area appears to be fill, based on its color and grading. This site slopes slightly toward Bartlett Ravine.

5.2.1.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize surface and subsurface soils beneath the former coal piles
- investigate shallow groundwater quality immediately downgradient of former coal storage piles (also downgradient of 137-137X area)
- provide groundwater elevation control in this area.

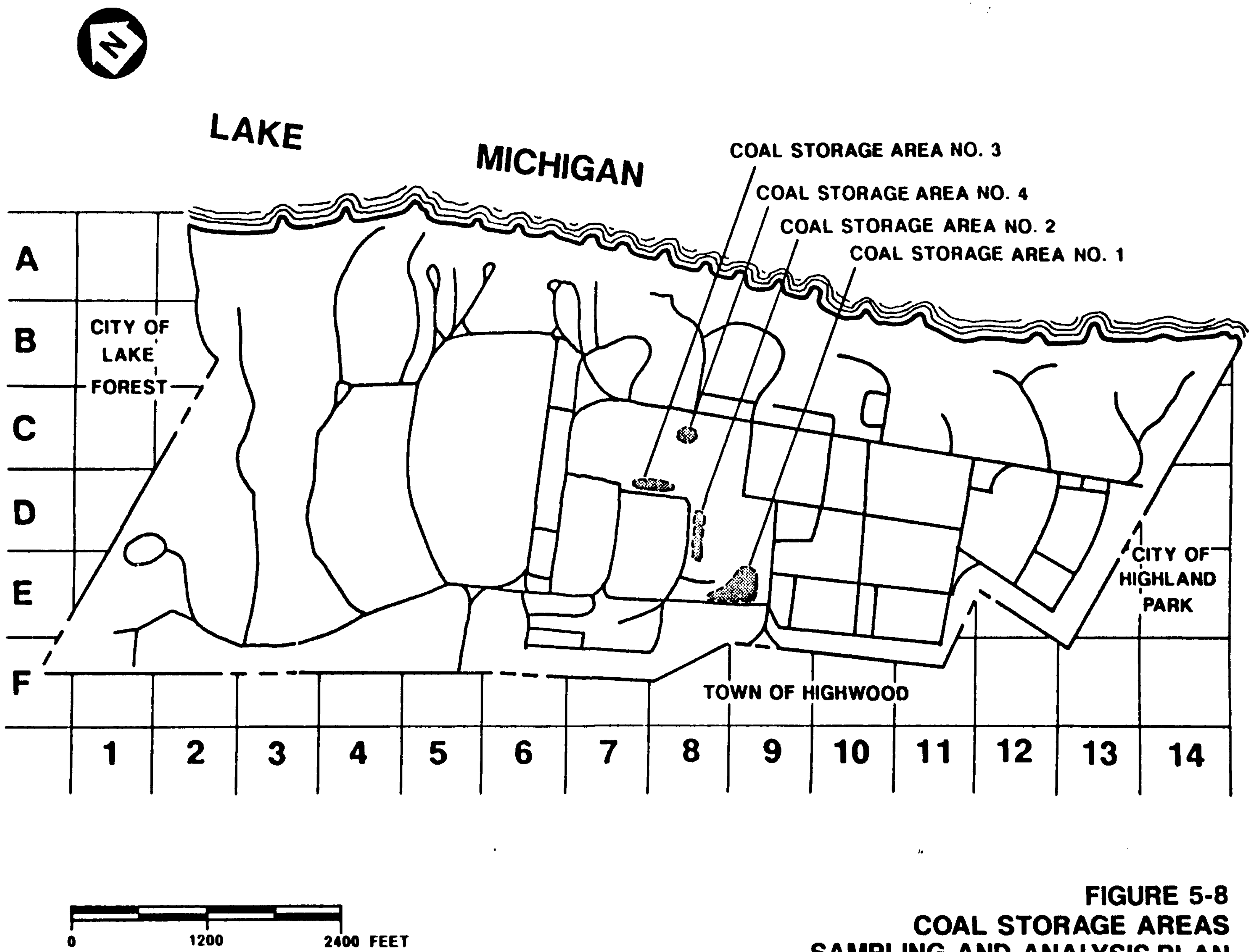

FIGURE 5-8
COAL STORAGE AREAS
SAMPLING AND ANALYSIS PLAN
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TABLE 5-4
BACKHOE, DRILLING AND MONITORING WELL SUMMARY
FOR COAL STORAGE AREAS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

EXPLORATION/SITE	NO. OF EXPLORATIONS	TOTAL DEPTH OF EXPLORATIONS (L.F.)	DEPTH TO GWT (FT.)	NO. OF SPLIT-SPOON SAMPLES CONT. (NO.)	NO. OF SPLIT-SPOON SAMPLES 5-FOOT (NO.)	PVC SCREEN (L.F.)	PVC RISER (L.F.)	BENT. PELLET SEAL (L.F.)	CLAY GROUT (L.F.)	PROTECTIVE WELL CASING	55-GALLON DRUMS	WELL DEVEL. (HRS)
Test Pits												
Coal Storage Area												
No. 1	2	30	15	--	--	--	--	--	--	--	--	--
2	2	30	15	--	--	--	--	--	--	--	--	--
3	2	30	15	--	--	--	--	--	--	--	--	--
4	2	30	15	--	--	--	--	--	--	--	--	--
Soil Borings												
Coal Storage Area												
No. 1	--	--	--	--	--	--	--	--	--	--	--	--
2	--	--	--	--	--	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--	--
Soil Borings with Monitoring Wells												
Coal Storage Area												
No. 1	1	25	15	12	--	10	15	5	3	1	2	12
2	--	--	--	--	--	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--	--

TABLE 5-5
SUMMARY OF ANALYTICAL SAMPLING PROGRAM FOR COAL STORAGE AREAS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

			NUMBER OF SAMPLES			
			TCL ANALYTICAL SERIES			
SITE AND EXPLORATION TYPE	NUMBER OF EXPLORATIONS	MEDIA	VOC	SVOC	ELEMENTS	PESTICIDES/PCBs
Coal Storage Area No. 1						
Test Pits	2	Soil	--	4	4	--
Borings	1	Soil	--	3	3	--
Monitoring Wells	1	Water	--	1	1	--
Coal Storage Area No. 2						
Test Pits	2	Soil	--	4	4	--
Borings	--	Soil	--	--	--	--
Monitoring Wells	--	Water	--	--	--	--
Coal Storage Area No. 3						
Test Pits	2	Soil	--	4	4	--
Borings	--	Soil	--	--	--	--
Monitoring Wells	--	Water	--	--	--	--
Coal Storage Area No. 4						
Test Pits	2	Soil	--	4	4	--
Borings	--	Soil	--	--	--	--
Monitoring Wells	--	Water	--	--	--	--
Total Soil Samples				19	19	--
Total Water Samples				1	1	

- o investigate the hydraulic properties of shallow soils through in-situ permeability tests and visual observation of fractures within the till

5.2.1.3 Exploration and Sampling Program. The following paragraphs outline the investigation program proposed to meet the technical objectives listed in Subsection 5.2.1.2. Figure 5-9 shows the exploration locations at Coal Storage Area No. 1.

Test Pit Program. A minimum of two test pits will be dug in the unpaved area beneath the former coal pile. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pt, using a backhoe and visual observation from the edge of the test pit. Two soil samples per test pit will be collected from the center of the backhoe bucket using a stainless steel spoon. One of the soil samples collected from each test pit will be from the surface. The analytical samples will be collected from soils that are either visibly stained or show elevated PID readings. The soil samples will be analyzed for TCL SVOCs and elements.

Soil Boring Program. One soil boring will be installed at Coal Storage Area No. 1. It will be positioned immediately downgradient of the former coal storage pile area (see Figure 5-9). The actual location of the boring may be adjusted in the field based on the findings of the test pit investigation. The boring will be completed as a shallow boring, estimated to be 25 feet in depth, approximately 10 feet below the water table. The boring will be sampled continuously, using split-spoon samplers. Soil samples will be screened in the field using a portable PID. If elevated PID readings are detected in the soils from the bottom of the borehole, the borehole will be advanced further, until a minimum of two split-spoon soil samples shows no elevated PID levels. If the resultant borehole is more than three feet below the anticipated bottom of the monitoring well screen, the bottom of the borehole will be grouted with a high solids bentonite grout up to 3 feet within the expected bottom of the screen. If this procedure cannot be adequately completed, the entire borehole will be grouted to ground surface and a new borehole adjacent to this borehole will be drilled for well installation purposes. (See the QAPP, Data Item A006 for a description of grouting procedures and specifications.)

Based on the field screening results, three soil samples from the boring will be submitted for laboratory analysis. The soil samples from the boring will be analyzed for TCL SVOCs and elements.

Monitoring Well Installation. Based on the EPIC interpretation of aerial photographs, Coal Storage Area No. 1 appears to have been the largest of the coal storage areas and because of its location adjacent to a railroad spur, probably experienced the most activity. If coal storage has impacted groundwater quality at Fort Sheridan, this site theoretically should provide the worst-case scenario. Therefore, to assess the potential impact of coal-derived chemcials (primarily PAHs and metals) on shallow groundwater, a water table monitoring well will be installed at Coal Storage Area No. 1. This well also serves as the only downgradient monitoring well for the 137, 137X, 139 Area, and will provide a needed groundwater elevation monitoring point in the area.

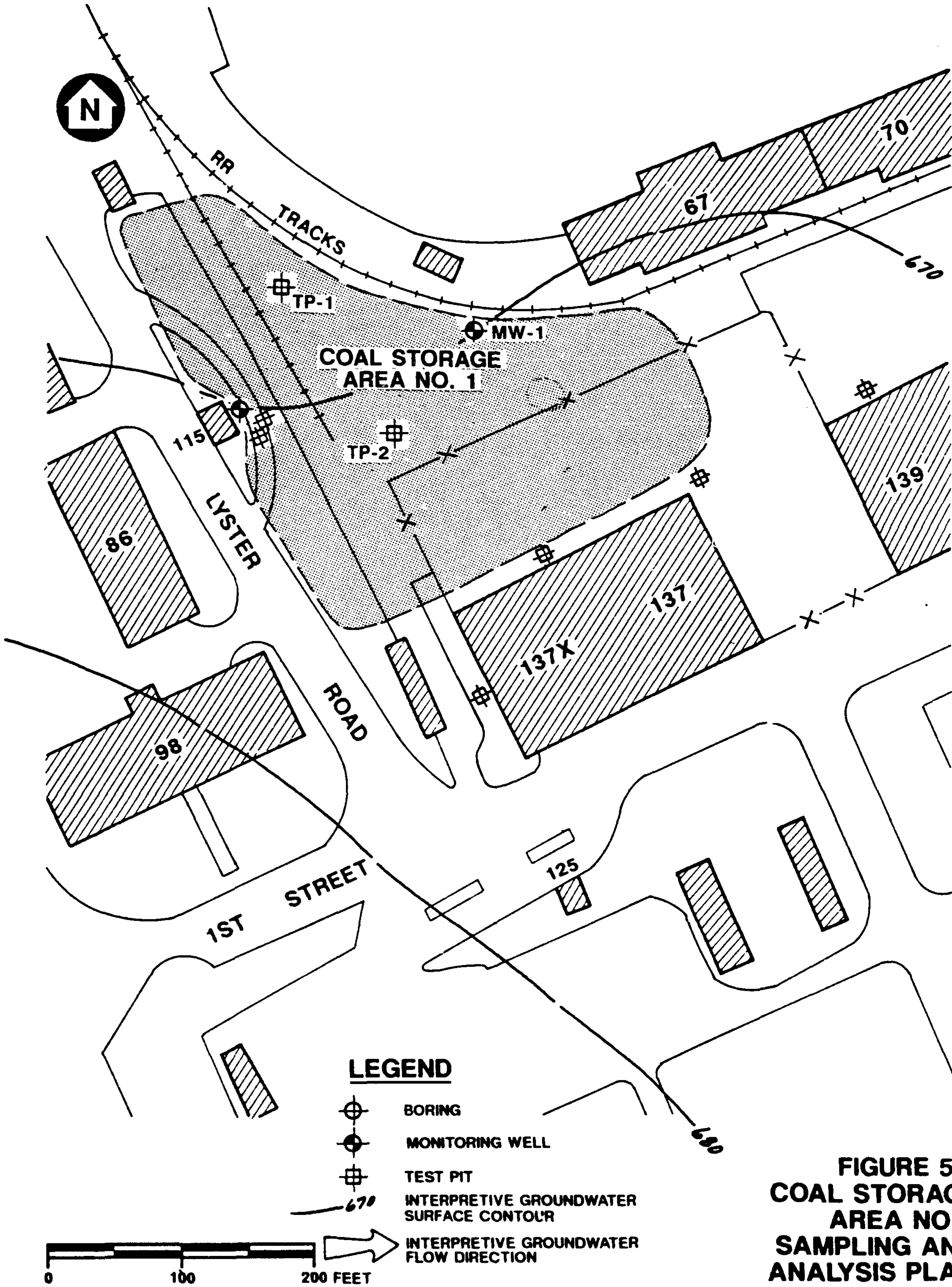

FIGURE 5-9
COAL STORAGE
AREA NO. 1
SAMPLING AND
ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

A 4-inch ID monitoring well will be installed in the borehole upon completion. The monitoring well will be constructed of flush-joint, threaded Schedule 40 PVC pipe and screen. The screen will be positioned to extend from approximately 2 feet above the water table to 8 feet below. The annulus around the wellscreen and at least 5 feet above the top of the screen will be backfilled with clean silica sand. A minimum 5-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be equipped with a 5-foot-long steel protective casing with lock which extends approximately 2.5 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

Upon completion, the monitoring well will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, the well will be developed using block and surge techniques. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the well will be developed by purging five well volumes or an alternate method as approved by USATHAMA.

In-situ permeability tests will be conducted in the well to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

One round of groundwater samples will be collected at this site. Sampling will not occur sooner than 14 days following well development or permeability testing. Groundwater samples will be monitored for TCL SVOCs and elements.

5.2.2 Coal Storage Area No. 2

5.2.2.1 Site Description. This site is located between the railroad siding along Thorpe Road and Bartlett Ravine. It covers almost the entire distance between Building 119 and Chapman Road (approximately 500 feet). This area is now occupied by a paved parking lot, a grassed area, four 30,000-gallon USTs, and the heating plant. The site slopes slightly toward Bartlett Ravine.

5.2.2.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize surface and subsurface soils beneath the former coal piles

- investigate the hydraulic properties of shallow soils through visual observation of fractures within the till

5.2.2.3 Exploration and Sampling Program. The following paragraphs outline the investigation program proposed to meet the technical objectives listed in Subsection 5.2.2.2. Figure 5-10 shows the exploration locations for Coal Storage Area No. 2.

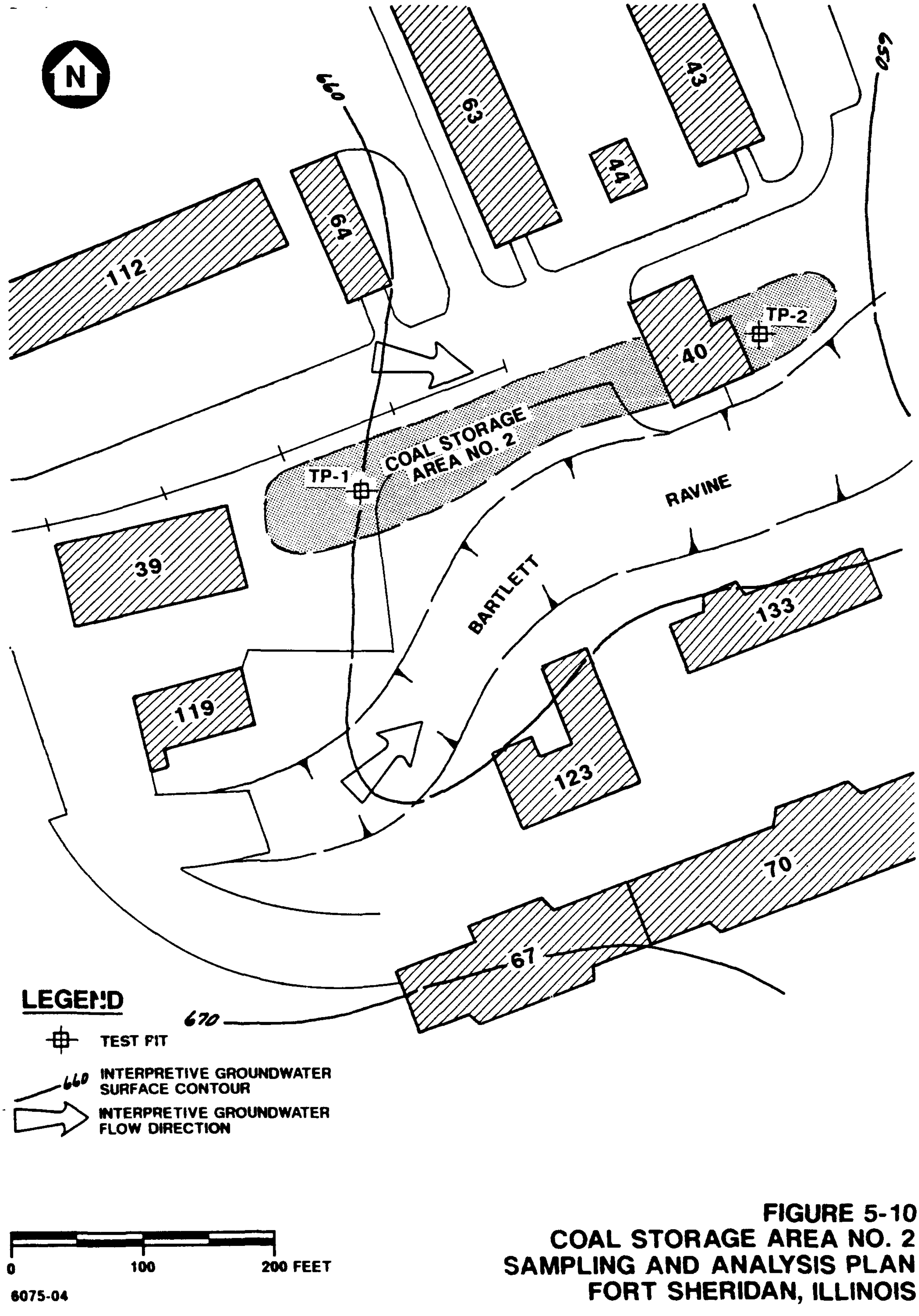

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FIGURE 5-10
COAL STORAGE AREA NO. 2
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

Test Pit Program. A minimum of two test pits will be dug in the unpaved area beneath the former coal pile. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pit and visual observation from the edge of the test pit. Two analytical soil samples per test pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. One of the soil samples collected from each test pit will be from the surface. The analytical samples should be collected from soils that are either visibly stained or show elevated PID readings. The soil samples will be analyzed for TCL SVOCs and elements.

5.2.3 Coal Storage Area No. 3

5.2.3.1 Site Description. This site is parallel to and extends the length of Chapman Road. This area is now partially covered by the swimming pool; the remainder of the site is grassed. The site slopes slightly toward Bartlett Ravine.

5.2.3.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize surface and subsurface soils beneath the former coal piles
- investigate the hydraulic properties of shallow soils through visual observation of fractures within the till

5.2.3.3 Exploration and Sampling Program. The following paragraphs outline the investigation program proposed to meet the technical objectives listed in Subsection 5.2.3.2. Figure 5-11 shows the exploration locations for Coal Storage Area No. 3.

Test Pit Program. A minimum of two test pits will be dug in the unpaved area beneath the former coal pile. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pit and visual observation from the edge of the test pit. One analytical soil sample per test pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. One of the soil samples collected from the test pit will be from the surface. The analytical sample should be collected from soils which are either visibly stained or which show elevated PID readings. The soil samples will be analyzed for TCL SVOCs and elements.

5.2.4 Coal Storage Area No. 4

5.2.4.1 Site Description. This site is located at what is now a grassed area between Bartlett Ravine and a gravel access way leading from Patten Road to the bowling alley (Building 162). In a 1952 aerial photograph, the site was approximately two-thirds of an acre in size and was roughly circular in shape. The site slopes slightly towards Bartlett Ravine.

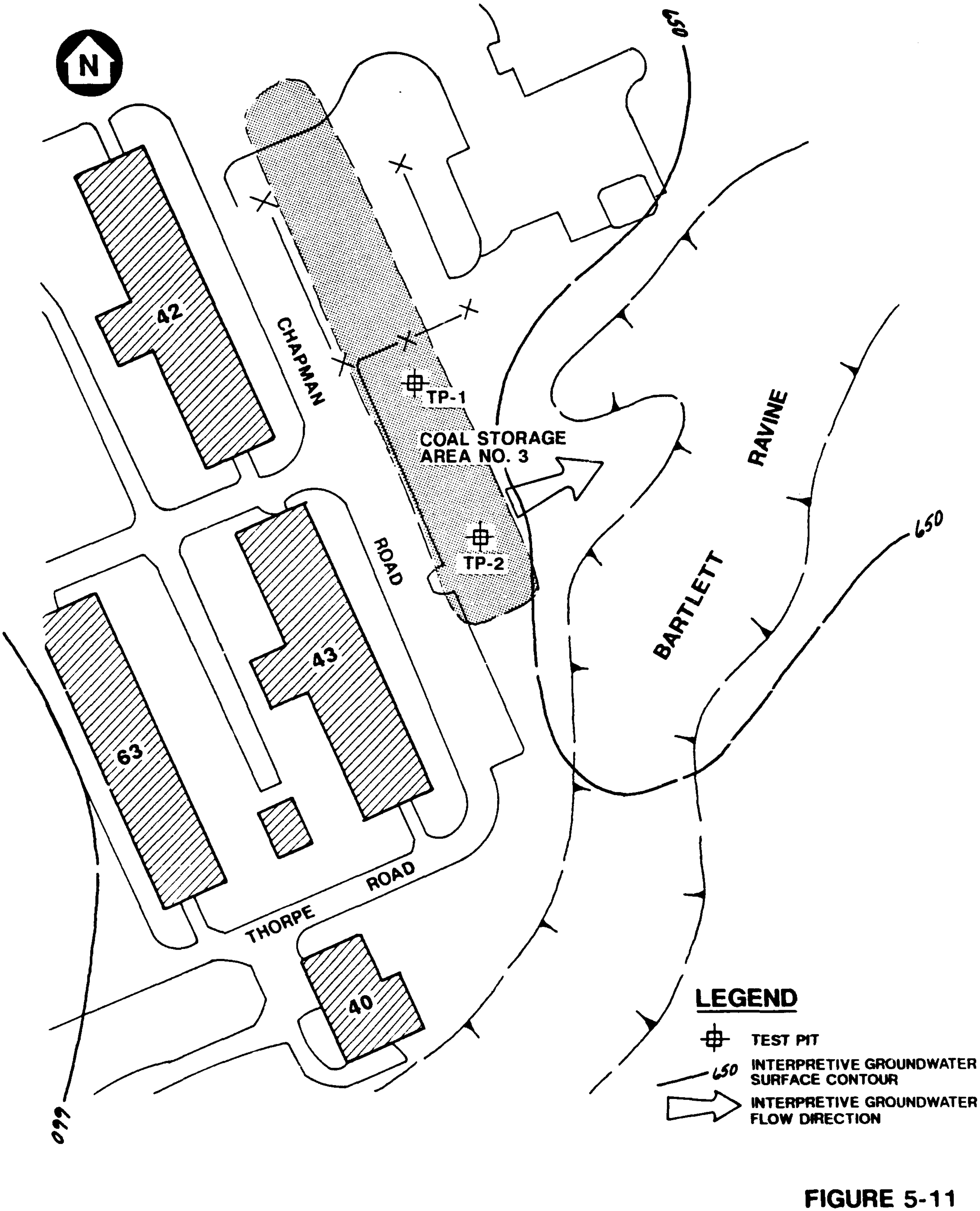

FIGURE 5-11
COAL STORAGE AREA NO. 3
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

5.2.4.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- o characterize surface and subsurface soils beneath the former coal piles

- o investigate the hydraulic properties of shallow soils through visual observation of fractures within the till

5.2.4.3 Exploration and Sampling Program. The following paragraphs outline the investigation program proposed to meet the technical objectives listed in Subsection 5.2.4.2. Figure 5-12 shows the exploration locations for Coal Storage Area No. 4.

Test Pit Program. A minimum of two test pits will be dug in the unpaved area beneath the former coal pile. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pit and visual observation from the edge of the test pit. One analytical soil sample per test pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. One of the soil samples collected from each test pit will be from the surface. The analytical sample should be collected from soils which are either visibly stained or which show elevated PID readings. The soil samples will be analyzed for TCL SVOCs and elements.

5.3 UNDERGROUND STORAGE TANKS

Three underground gasoline or diesel storage tank areas were identified by the draft Enhanced Preliminary Assessment as having failed pressure testing (Argonne National Laboratory, 1989). RI programs will be conducted at each of these sites, unless further testing indicates that no leaks exist. Other underground storage tanks which have not been identified as leaking are not included in the scope of this SAP. RI programs for underground storage tanks (USTs) at Buildings 115, 125, and 208 are discussed in the following sections. Figure 5-13 shows the UST site locations. Table 5-6 summarizes the exploration programs and Table 5-7 summarizes the sampling and analytical programs at the USTs.

5.3.1 UST at Building 115

5.3.1.1 Site Description. This is a 10,000-gallon UST located adjacent to Building 115 and currently used for diesel fuel. Results of leak testing on May 15, 1988, indicate that it may be leaking. This is a relatively flat site with little surface slope.

5.3.1.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- o characterize subsurface soils adjacent to, and immediately downgradient of the UST

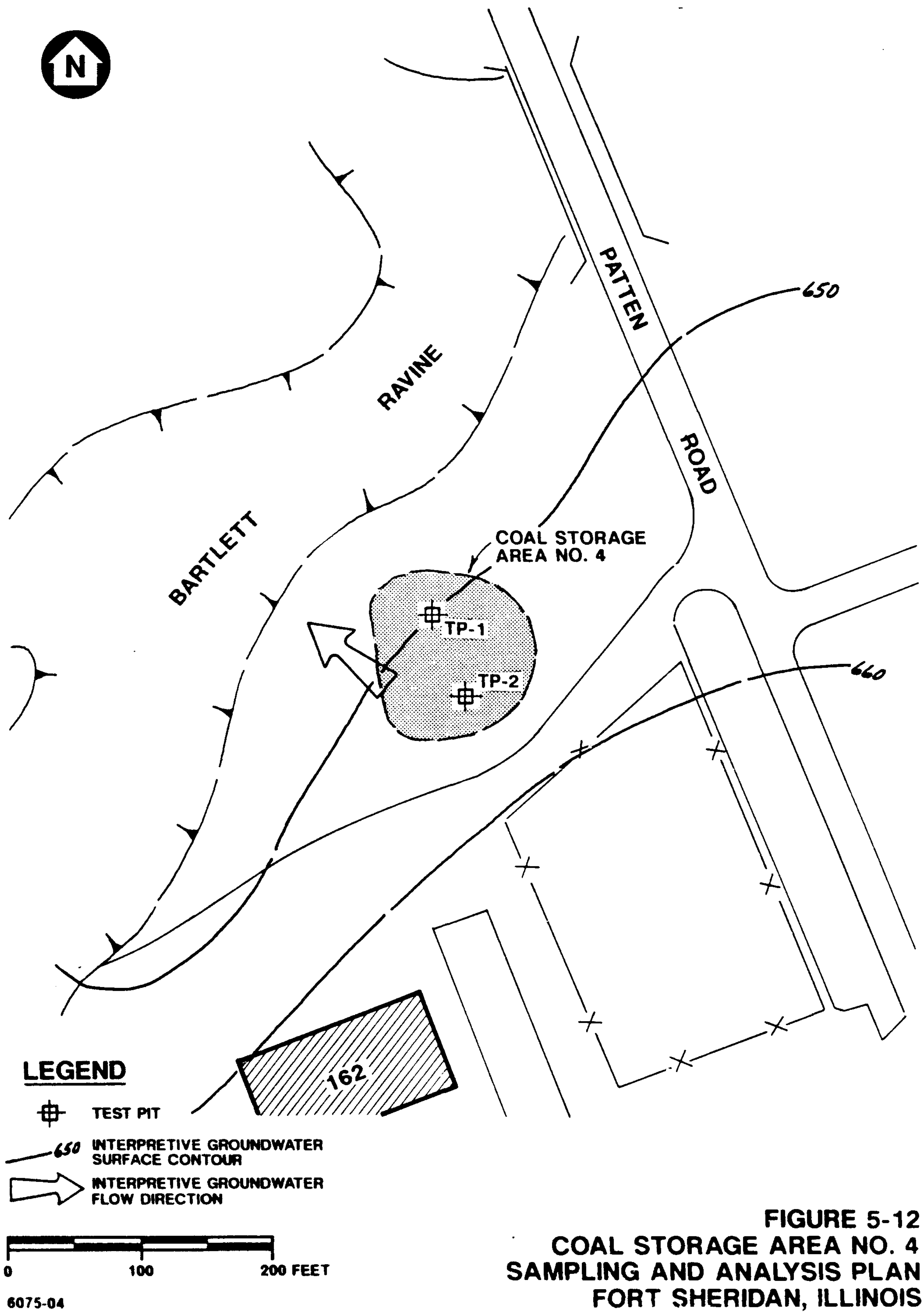

FIGURE 5-12
COAL STORAGE AREA NO. 4
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

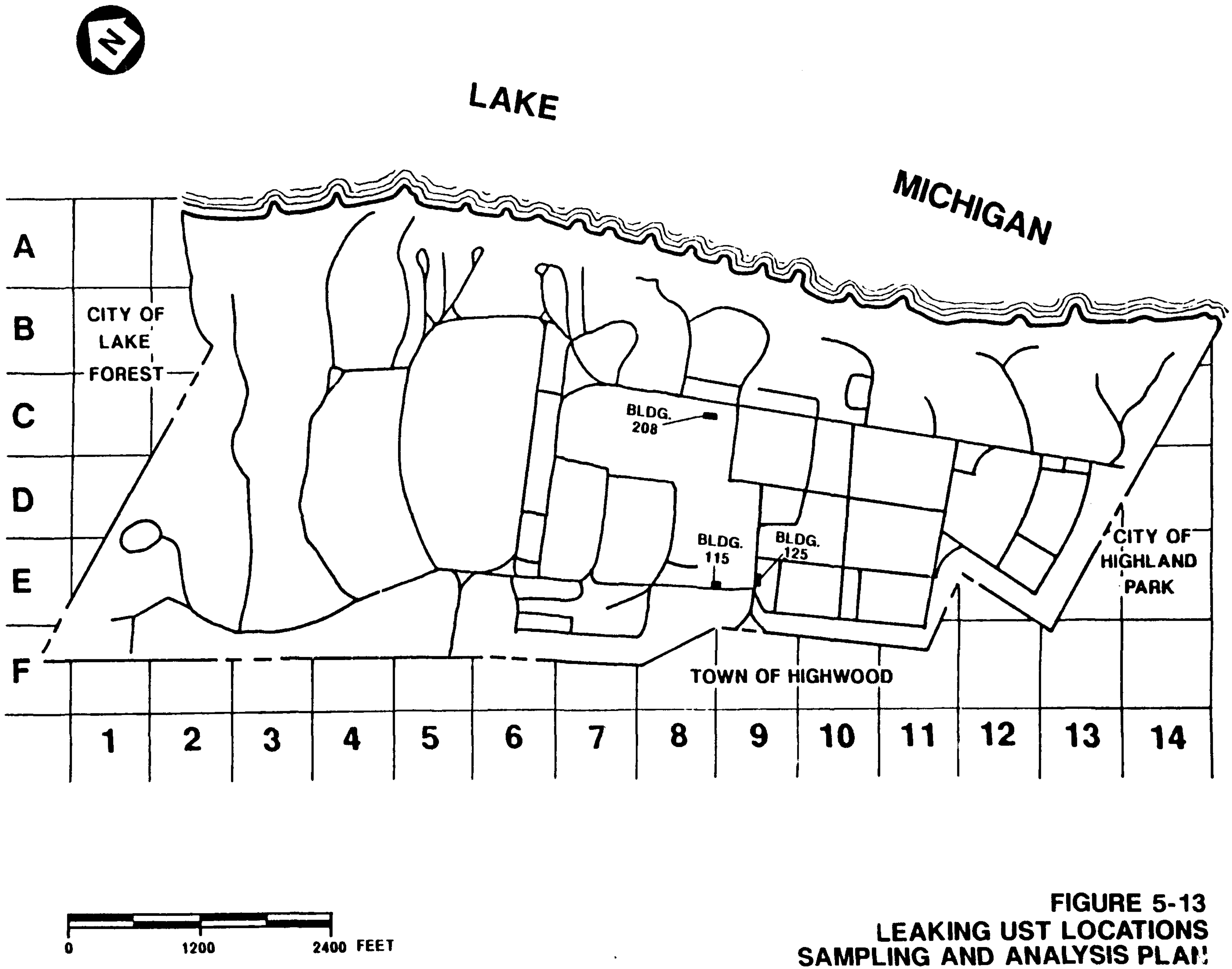

FIGURE 5-13
LEAKING UST LOCATIONS
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

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TABLE 5-6
BACKHOE, DRILLING AND MONITORING WELL SUMMARY
FOR UNDERGROUND STORAGE TANKS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

EXPLORATION/SITE	NO. OF EXPLORATIONS	TOTAL DEPTH OF EXPLORATIONS (L.F.)	DEPTH TO GWT (FT.)	NO. OF SPLIT-SPOON SAMPLES CONT. (NO.)	NO. OF SPLIT-SPOON SAMPLES 5-FOOT (NO.)	PVC SCREEN (L.F.)	PVC RISER (L.F.)	BENT. PELLET SEAL (L.F.)	CLAY GROUT (L.F.)	PROTECTIVE WELL CASING	55-GALLON DRUMS	WELL DEVEL. (HRS)
Test Pits												
UST at Building 115	2	30	15	--	--	--	--	--	--	--	--	--
UST at Building 125	2	30	15	--	--	--	--	--	--	--	--	--
UST at Building 208	2	30	15	--	--	--	--	--	--	--	--	--
Soil Borings												
UST at Building 115	--	--	--	--	--	--	--	--	--	--	--	--
UST at Building 125	--	--	--	--	--	--	--	--	--	--	--	--
UST at Building 208	--	--	--	--	--	--	--	--	--	--	--	--
Soil Borings with Monitoring Wells												
UST at Building 115	1	25	15	12	--	10	15	5	3	1	2	12
UST at Building 125	1	25	15	12	--	10	15	5	3	1	2	12
UST at Building 208	1	25	15	12	--	10	15	5	3	1	2	12

TABLE 5-7
SUMMARY OF ANALYTICAL SAMPLING PROGRAM FOR USTs

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

			NUMBER OF SAMPLES			
			TCL ANALYTICAL SERIES			
SITE AND EXPLORATION TYPE	NUMBER OF EXPLORATIONS	MEDIA	VOC	SVOC	ELEMENTS	PESTICIDES/PCBs
UST at Building 115						
Test Pits	2	Soil	4	4	4	--
Borings	1	Soil	3	3	3	--
Monitoring Wells	1	Water	1	1	1	--
USTs at Building 125						
Test Pits	2	Soil	4	4	4	--
Borings	1	Soil	3	3	3	--
Monitoring Wells	1	Water	1	1	1	--
USTs at Building 208						
Test Pits	2	Soil	4	4	4	--
Borings	1	Soil	3	3	3	--
Monitoring Wells	1	Water	1	1	1	--
Total Soil Samples			21	21	21	--
Total Water Samples			3	3	3	--

- investigate shallow groundwater quality immediately downgradient of potentially leaking UST

- investigate the hydraulic properties of shallow soils through in-situ permeability tests and visual observation of fractures within the till

5.3.1.3 Exploration and Sampling Program. Prior to any invasive work around USTs, a metal detector will be used to locate the edges of the UST. The area will be flagged or marked on the ground with paint. Fort Sheridan will be responsible for clearing all underground utilities and structures. Figure 5-14 shows the exploration locations around the UST at Building 115.

Test Pit Program. A minimum of two test pits will be dug as close as possible to the UST on the downgradient (east) and southeast sides to investigate subsurface soils, determine depth to the water table, and check for the presence of free product. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on materials excavated with the backhoe and visual observation from the edge of the test pit. Two analytical two soil samples per test pit will be collected from the center of the backhoe bucket using a stainless steel spoon. The soil samples collected from the test pit will likely be from at or below the water table. The analytical samples should be collected from soils which are either visibly stained or which show elevated PID readings. The soil samples will be analyzed for TCL VOCs, SVOCs and elements.

Soil Boring Program. One soil boring will be installed immediately downgradient of the UST. The proposed location is shown in Figure 5-14. The actual location of the boring may be adjusted in the field based on the findings of the test pit investigation. The boring will be completed as a shallow boring, estimated to be 25 feet in depth, approximately 10 feet below the water table. The boring will be sampled continuously, using split-spoon samplers. Soil samples will be screened in the field using a portable PID. If elevated PID readings are detected in the soils from the bottom of the borehole, the borehole will be advanced further, until a minimum of two split-spoon soil samples shows no elevated PID levels. If the resultant borehole is more than three feet below the anticipated bottom of the monitoring well screen, the bottom of the borehole will be grouted with a high solids bentonite grout up to 3 feet from the expected bottom of the screen. (See the QAPP, Data Item A0006 for a description of grouting procedures and specifications).

Based on the field screening results, three soil samples from the boring will be submitted for laboratory analysis. The soil samples from the boring will be analyzed for TCL VOCs, SVOCs and elements.

Monitoring Well Installation. A 4-inch ID monitoring well will be installed in the borehole upon completion. The monitoring well will be constructed of flush-joint, threaded Schedule 40 PVC pipe and screen. The screen will be positioned to extend from approximately 2 feet above the water table to 8 feet below. The annulus around the wellscreen, and at least 5 feet above the top of the screen, will be backfilled with clean silica sand. A minimum 5-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be

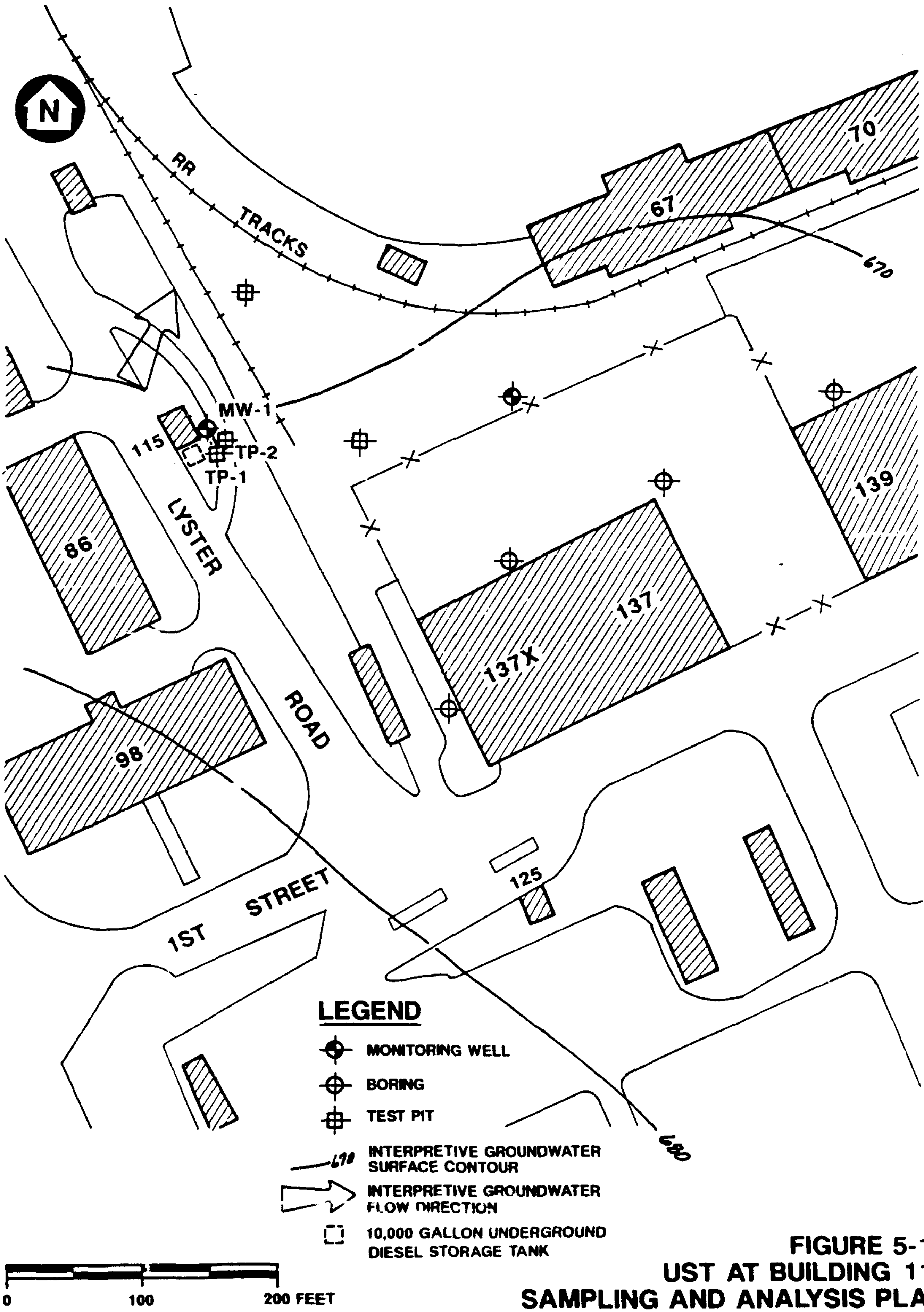

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FIGURE 5-14
UST AT BUILDING 115
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

equipped with a 5-foot-long steel protective casing with lock which extends approximately 2.5 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

Upon completion, the monitoring well will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, the well will be developed using block and surge techniques. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the well will be developed by purging five well volumes or an alternate method as approved by USATHAMA.

In-situ permeability tests will be conducted in the well to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

One groundwater sample will be collected from the well at this site. Sampling will not occur sooner than 14 days following well development or permeability testing. The groundwater sample will be analyzed for TCL VOCs, SVOCs, and elements.

5.3.2 USTs at Building 125

5.3.2.1 Site Description. Two 12,000-gallon USTs used to store unleaded gasoline are located at Building 125. Results of leak testing on May 17, 1988, indicate they may be leaking. This is a relatively flat site with little surface slope.

5.3.2.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize subsurface soils adjacent to the two 12,000-gallon USTs
- investigate shallow groundwater quality immediately downgradient of potentially leaking USTs
- investigate the hydraulic properties of shallow soils through in-situ permeability tests and visual observation of fractures within the till

5.3.2.3 Exploration and Sampling Program. Prior to any invasive work around USTs, a metal detector will be used to locate the edges of the USTs. The area will be flagged or marked on the ground with paint. Figure 5-15 shows the exploration locations around the UST at Building 125.

Test Pit Program. A minimum of two test pits will be dug as close as possible and immediately downgradient from the USTs to investigate subsurface soils, and check for the presence of free product. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pit and visual observation from the edge of the test pit. Two analytical soil

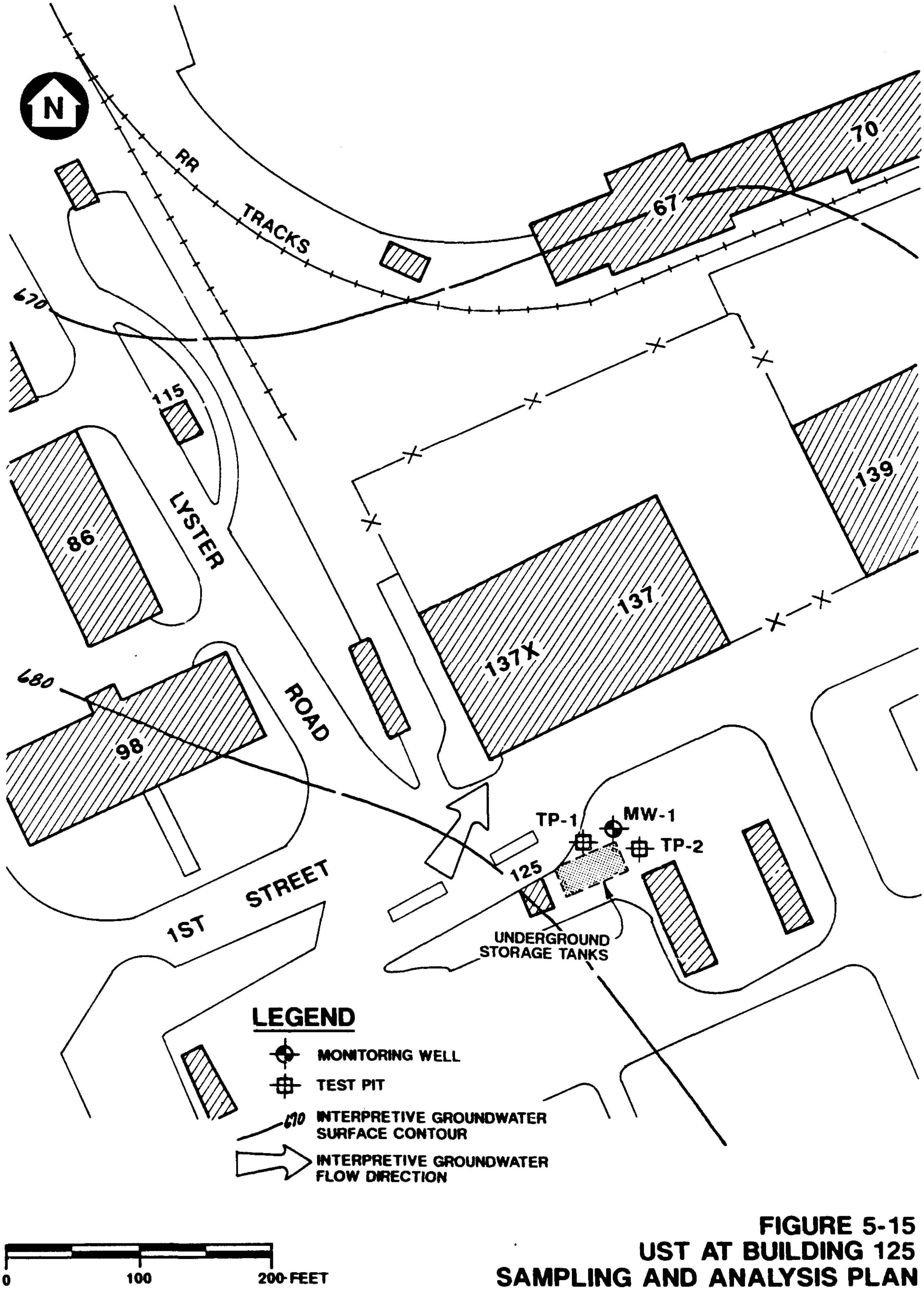

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FIGURE 5-15
UST AT BUILDING 125
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

samples per test pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. Soil samples will be collected at the water table. The analytical samples should be collected from soils which are either visibly stained or which show elevated PID readings. The soil samples will be analyzed for TCL VOCs, SVOCs and elements.

Soil Boring Program. One soil boring will be installed immediately downgradient of the USTs. The proposed location is shown in Figure 5-15. The actual location of the boring may be adjusted in the field based on the findings of the test pit investigation. The boring will be completed as a shallow boring, estimated to be 25 feet in depth, approximately 10 feet below the water table. The boring will be sampled continuously, using split-spoon samplers. Soil samples will be screened in the field using a portable PID. If elevated PID readings are detected in the soils from the bottom of the borehole, the borehole will be advanced further, until a minimum of two split-spoon soil samples shows no elevated PID levels. If the resultant borehole is more than 3 feet below the anticipated bottom of the screen, the bottom of the borehole will be grouted with a high solids bentonite grout up to 3 feet from the expected bottom of the screen or the borehole will be grouted and a new borehole will be drilled for well installation purposes. (See the QAPP, Data Item A0006 for a description of grouting procedures and specifications.)

Based on the field screening results, three soil samples from the boring will be submitted for laboratory analysis. The soil samples from the boring will be analyzed for TCL VOCs, SVOCs and elements.

Monitoring Well Installation. A 4-inch ID monitoring well will be installed in the borehole upon completion. The monitoring well will be constructed of flush-joint, threaded Schedule 40 PVC pipe and screen. The screen will be positioned to extend from approximately 2 feet above the water table to 8 feet below. The annulus around the wellscreen, and at least 5 feet above the top of the screen, will be backfilled with clean silica sand. A minimum 2-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be equipped with a 5-foot-long steel protective casing with lock which extends approximately 2.5 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

Upon completion, the monitoring well will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, the well will be developed using block and surge techniques. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the well will be developed by purging five well volumes or an alternate method as approved by USATHAMA.

In-situ permeability tests will be conducted in the well to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

One groundwater sample will be collected from the well at this site. Sampling will not occur sooner than 14 days following well development or permeability testing. The groundwater sample sill be analyzed for TCL VOCs, SVOCs, and elements.

5.3.3 USTs at Building 208

5.3.3.1 Site Description. There are three 10,000-gallon USTs used to store regular, premium, and unleaded gasoline at Building 208. Leak testing performed on May 18, 1988, indicated that a product line to one of the tanks may be leaking. This is a relatively flat site with little surface slope.

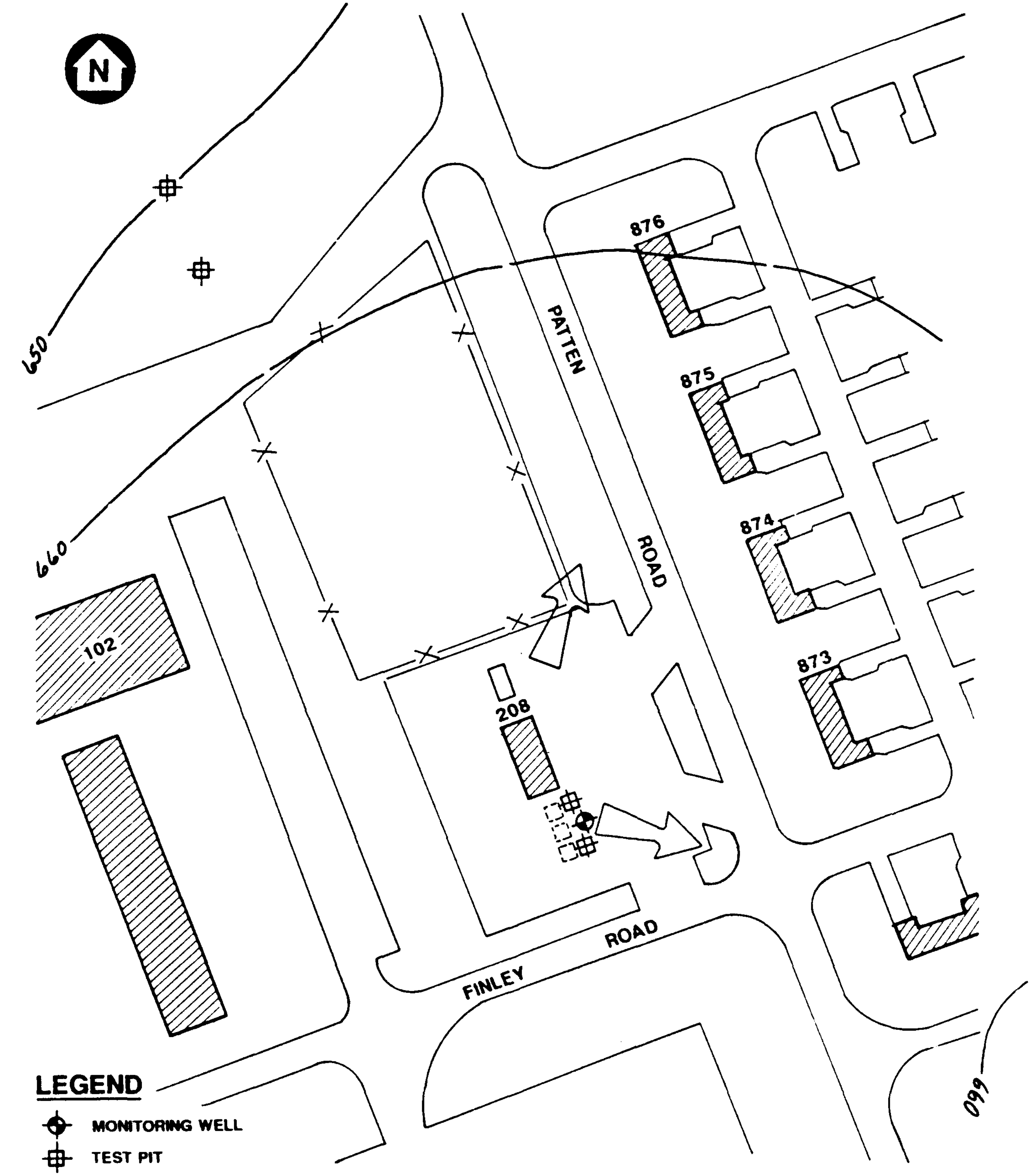
5.3.3.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- o characterize subsurface soils adjacent to the USTs
- o investigate shallow groundwater quality immediately downgradient of leaking USTs
- o investigate the hydraulic properties of shallow soils through in-situ permeability tests and visual observation of fractures within the till

5.3.3.3 Exploration and Sampling Program. Prior to any invasive work around USTs, a metal detector will be used to locate the edges of the USTs. The area will be flagged or marked on the ground with paint. Figure 5-16 shows the exploration locations around the UST at Building 208.

Test Pit Program. A minimum of two test pits will be dug as close as possible to the UST to investigate subsurface soils, and check for the presence of free product. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pit and visual observation from the edge of the test pit. Two analytical soil samples per test pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. The soil samples collected from the test pits will likely be from at or below the water table. The analytical samples should be collected from soils which are either visibly stained or which show elevated PID readings. The soil samples will be analyzed for TCL VOCs, SVOCs and elements.

Soil Boring Program. One soil boring will be installed immediately downgradient of the USTs. The proposed location is shown in Figure 5-16. The actual location of the boring may be adjusted in the field based on the findings of the test pit investigation. The boring will be completed as a shallow boring, estimated to be 25 feet in depth, approximately 10 feet below the water table. The boring will be sampled continuously, using split-spoon samplers. Soil samples will be screened in the field using a portable PID. If elevated PID readings are detected in the soils from the bottom of the borehole, the borehole will be advanced further, until a minimum of two split-spoon soil samples shows no elevated PID levels. If the resultant borehole is more than 3 feet below the anticipated bottom of the screen, the bottom of the borehole will be grouted



LEGEND

- MONITORING WELL
- TEST PIT
- INTERPRETIVE GROUNDWATER SURFACE CONTOUR (650)
- INTERPRETIVE GROUNDWATER FLOW DIRECTION
- 10,000 GALLON UNDERGROUND GASOLINE STORAGE TANKS

0 100 200 FEET

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FIGURE 5-16
UST AT BUILDING 208
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

with a high solids bentonite grout up to 3 feet from the expected bottom of the screen. (See the QAPP, Data Item A0006 for a description of grouting procedures and specifications).

Based on the field screening results, three soil samples from the boring will be submitted for laboratory analysis. The soil samples from the boring will be analyzed for TCL VOCs, SVOCs and metals.

Monitoring Well Installation. A 4-inch ID monitoring well will be installed in the borehole upon completion. The monitoring well will be constructed of flush-joint, threaded Schedule 40 PVC pipe and screen. The screen will be positioned to extend from approximately two feet above the water table to 8 feet below. The annulus around the wellscreen, and at least 5 feet above the top of the screen, will be backfilled with clean silica sand. A minimum 5-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be equipped with a 5-foot-long steel protective casing with lock which extends approximately 2.5 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

Upon completion, the monitoring well will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, the well will be developed using block and surge techniques. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the well will be developed by purging five well volumes or an alternate method as approved by USATHAMA.

In-situ permeability tests will be conducted in the well to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

A groundwater sample will be collected from the well at this site. Sampling will not occur sooner than 14 days following well development or permeability testing. The groundwater sample will be analyzed for TCL VOCs, SVOCs, and elements.

5.4 VEHICLE AND EQUIPMENT STORAGE AREAS

Based on review of the draft Enhanced Preliminary Assessment and EPIC's interpretation of aerial photographs, RI programs are described in this section for six VES areas. In addition, this section includes RI programs for open storage areas at Building 122 and behind Buildings 137X, 137, and 139. Figure 5-17 shows the locations of the sites. Table 5-8 summarizes the exploration programs and Table 5-9 summarizes the sampling and analytical programs at the VES sites.

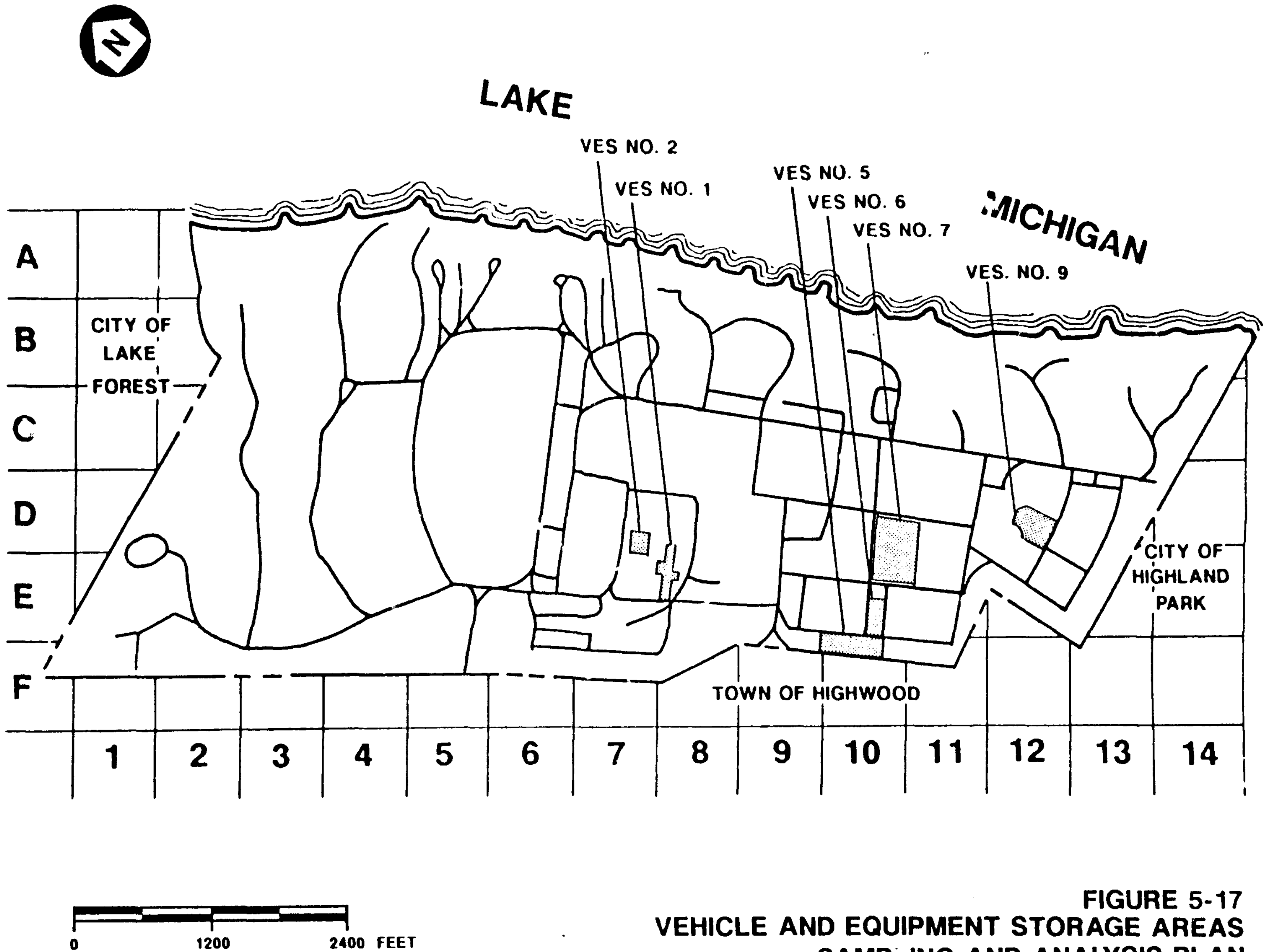

FIGURE 5-17
VEHICLE AND EQUIPMENT STORAGE AREAS
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

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5.4.1 Vehicle and Equipment Storage Area No. 1

5.4.1.1 Site Description. VES Area No. 1 consists of the nearly level, paved parking area between Buildings 51, 55, 58, and 112. Prior to 1989 and dating back to the 1950s, the motor pool in Building 51 was the location for maintenance of post automobiles. Although Argonne National Laboratory reports that solvents, waste oil, and maintenance-related fluids were collected in drums for disposal, it is very likely that spills and leaks occurred in this area. EPIC reports staining of the ground surface in this area observed in aerial photographs from 1962 and 1972.

5.4.1.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize subsurface soils beneath the vehicle and equipment storage area
- investigate the hydraulic properties of shallow soils through visual observation of fractures within the till

5.4.1.3 Exploration and Sampling Program. Figure 5-18 shows the exploration locations at VES No. 1.

Test Pit Program. A minimum of three test pits will be dug at VES No. 1 to investigate surface and subsurface soils in areas where visible staining has been observed. If necessary, a jack hammer will be used to remove the pavement prior to test pitting. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pit and visual observation from the edge of the test pit. Two analytical soil samples per test pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. The analytical samples should be collected from shallow soils (upper 5 feet) which are visibly stained and/or show elevated PID readings. The soil samples will be analyzed for TCL VOCs and SVOCs.

5.4.2 Vehicle and Equipment Storage Area No. 2

5.4.2.1 Site Description. VES Area No. 2 consists of the nearly level, paved area between Buildings 42 and 62. The EPIC interpretation of aerial photographs from 1952, 1962, 1972, 1980, and 1985 identifies this area as a vehicle and equipment storage lot. Ground-staining was observed in the photographs from 1952, 1962, 1972, and 1980.

5.4.2.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize subsurface soils beneath the vehicle and equipment storage area
- investigate the hydraulic properties of shallow soils through visual observation of fractures within the till

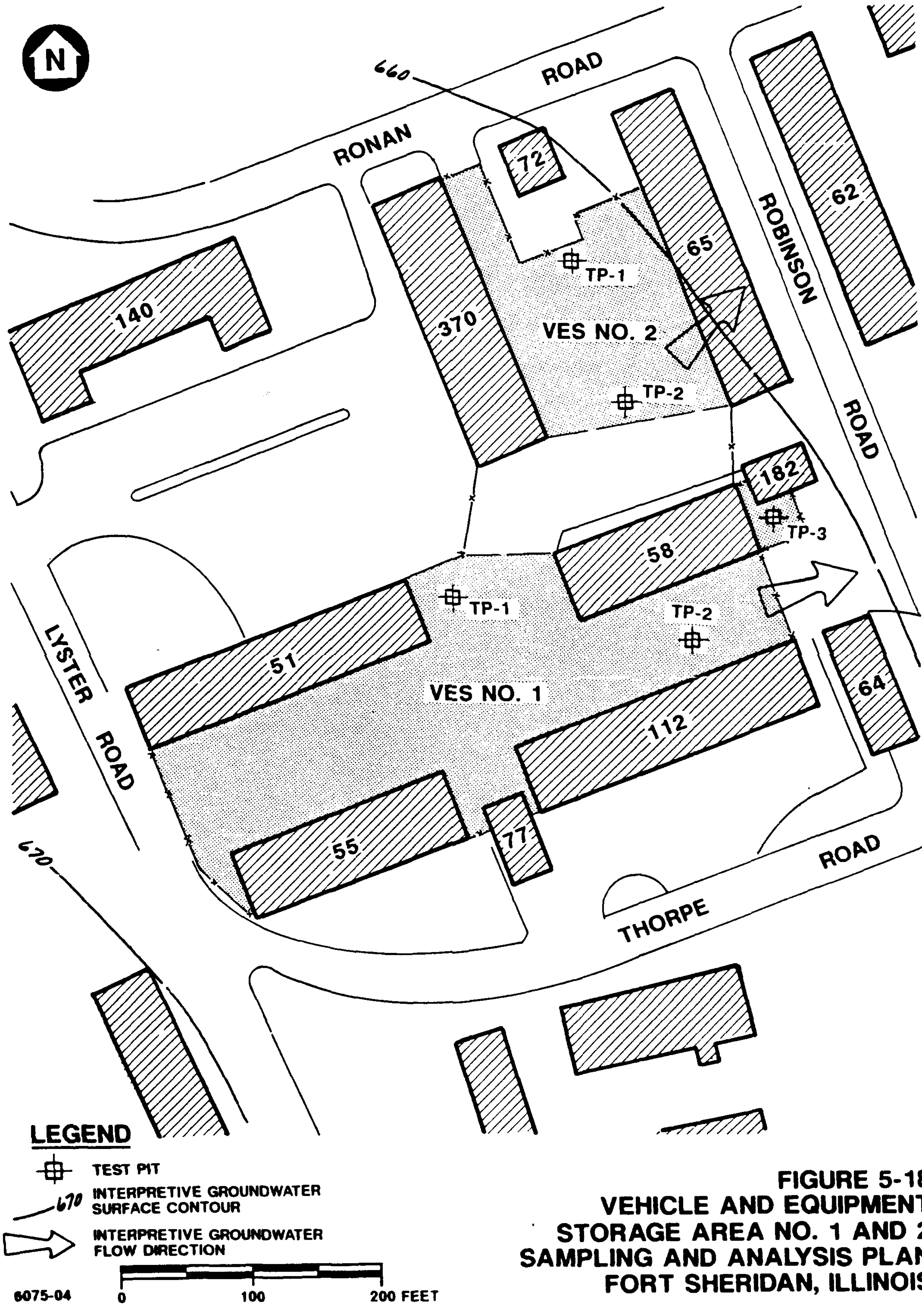

FIGURE 5-18
VEHICLE AND EQUIPMENT STORAGE AREA NO. 1 AND 2
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

5.4.2.3 Exploration and Sampling Program. Figure 5-18 shows the exploration locations at VES No. 2.

Test Pit Program. A minimum of two test pits will be dug at VES No. 2 to investigate surface and subsurface soils in areas where visible staining has been observed. If necessary, a jackhammer will be used to remove the pavement prior to test-pitting. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated material from the test pit and visual observation from the edge of the test pit. Two analytical soil samples per test pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. The analytical samples should be collected from shallow soils (upper 5 feet) which are visibly stained and/or show elevated PID readings. The soil samples will be analyzed for TCL VOCs and SVOCs.

5.4.3 Vehicle and Equipment Storage Area No. 5

5.4.3.1 Site Description. VES Area No. 5 is an approximate 100-by-500-foot area located west of Building 128 between D Street and the post boundary. It is active in aerial photographs from 1952 to 1985. Although there is no record of spills at this site, leaks or spills of POL or other hazardous substances may have occurred. EPIC identified ground-staining at this area in aerial photographs from 1962 and 1980 through 1985. This area is nearly level, graveled, and still used for vehicle storage.

5.4.3.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize subsurface soils beneath the vehicle and equipment storage area

- investigate the hydraulic properties of shallow soils through visual observation of fractures within the till

5.4.3.3 Exploration and Sampling Program. Figure 5-19 shows the exploration locations at VES No. 5.

Test Pit Program. A minimum of two test pits will be dug at VES No. 5 to investigate surface and subsurface soils in areas where visible staining has been observed. If necessary, a jack hammer will be used to remove the pavement prior to testpitting. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pit. Visual observation will be from the edge of the test pit. Two soil samples per test pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. The analytical samples should be collected from shallow soils (upper five feet) which are visibly stained and/or show elevated PID readings. The soil samples will be analyzed for TCL VOCs and SVOCs.

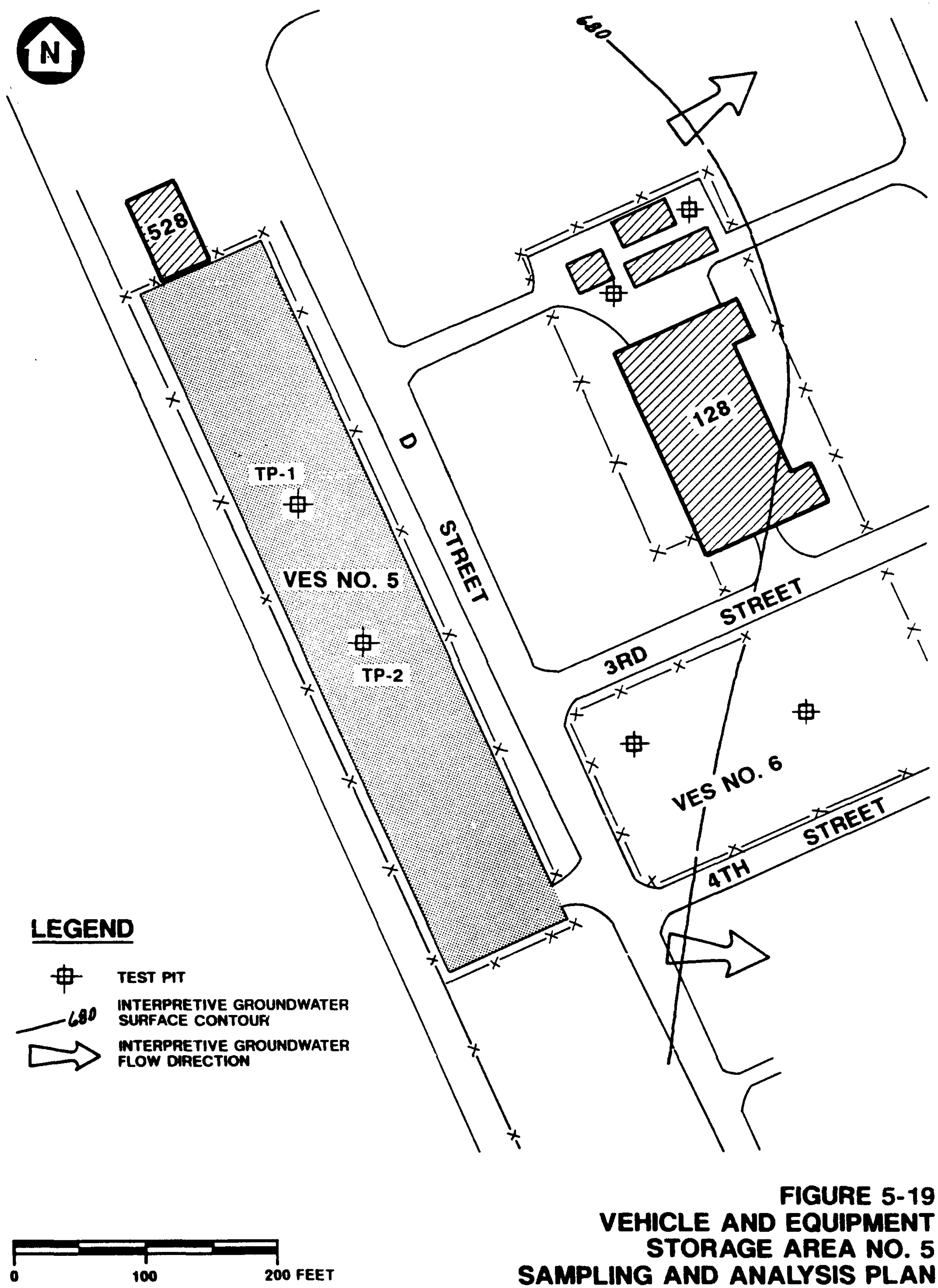

FIGURE 5-19
VEHICLE AND EQUIPMENT STORAGE AREA NO. 5 SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

5.4.4 Vehicle and Equipment Storage Area No. 6

5.4.4.1 Site Description. VES Area No. 6 is a nearly level, graveled area located south of Building 128 and is bounded by 3rd, 4th, C, and D streets. EPIC identifies it as a VES area on aerial photographs from 1952 to 1985. Although there is no record of spills at this site, leaks or spills of POL or other hazardous substances may have occurred. EPIC identified ground-staining at this area in aerial photographs taken in 1981.

5.4.4.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- o characterize subsurface soils beneath the vehicle and equipment storage area
- o investigate the hydraulic properties of shallow soils through visual observation of fractures within the till

5.4.4.3 Exploration and Sampling Program. Figure 5-20 shows the exploration locations at VES No. 6.

Test Pit Program. A minimum of two test pits will be dug at VES No. 6 to investigate surface and subsurface soils in areas where visible staining has been observed. If necessary, a jack hammer will be used to remove the pavement prior to testpitting. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pit and visual observation from the edge of the test pit. Two analytical soil samples per test pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. The analytical samples should be collected from shallow soils (upper five feet) which are visibly stained and/or show elevated PID readings. The soil samples will be analyzed for TCL VOCs and SVOCs.

Soil Boring Program. One soil boring will be installed at the downgradient edge of VES No. 6 to characterize soils and groundwater quality from this heavily used area and VES No. 5. The proposed location is shown in Figure 5-20. The actual location of the boring may be adjusted in the field based on the findings of the test pit investigation. The boring will be completed as a shallow boring, estimated to be 25 feet in depth, approximately 10 feet below the water table. The boring will be sampled continuously, using split-spoon samplers. Soil samples will be screened in the field using a portable PID. If elevated PID readings are detected in the soils from the bottom of the borehole, the borehole will be advanced further, until a minimum of two split-spoon soil samples shows no elevated PID levels. If the resultant borehole is more than 3 feet below the anticipated bottom of the monitoring well screen, the bottom of the borehole will be grouted with a high solids bentonite grout up to 3 feet from the expected bottom of the screen. (See the QAPP, Data Item A0006 for a description of grouting procedures and specifications).

Based on the field screening results, three soil samples from the boring will be submitted for laboratory analysis. The soil samples from the boring will be analyzed for TCL VOCs, SVOCs and elements.

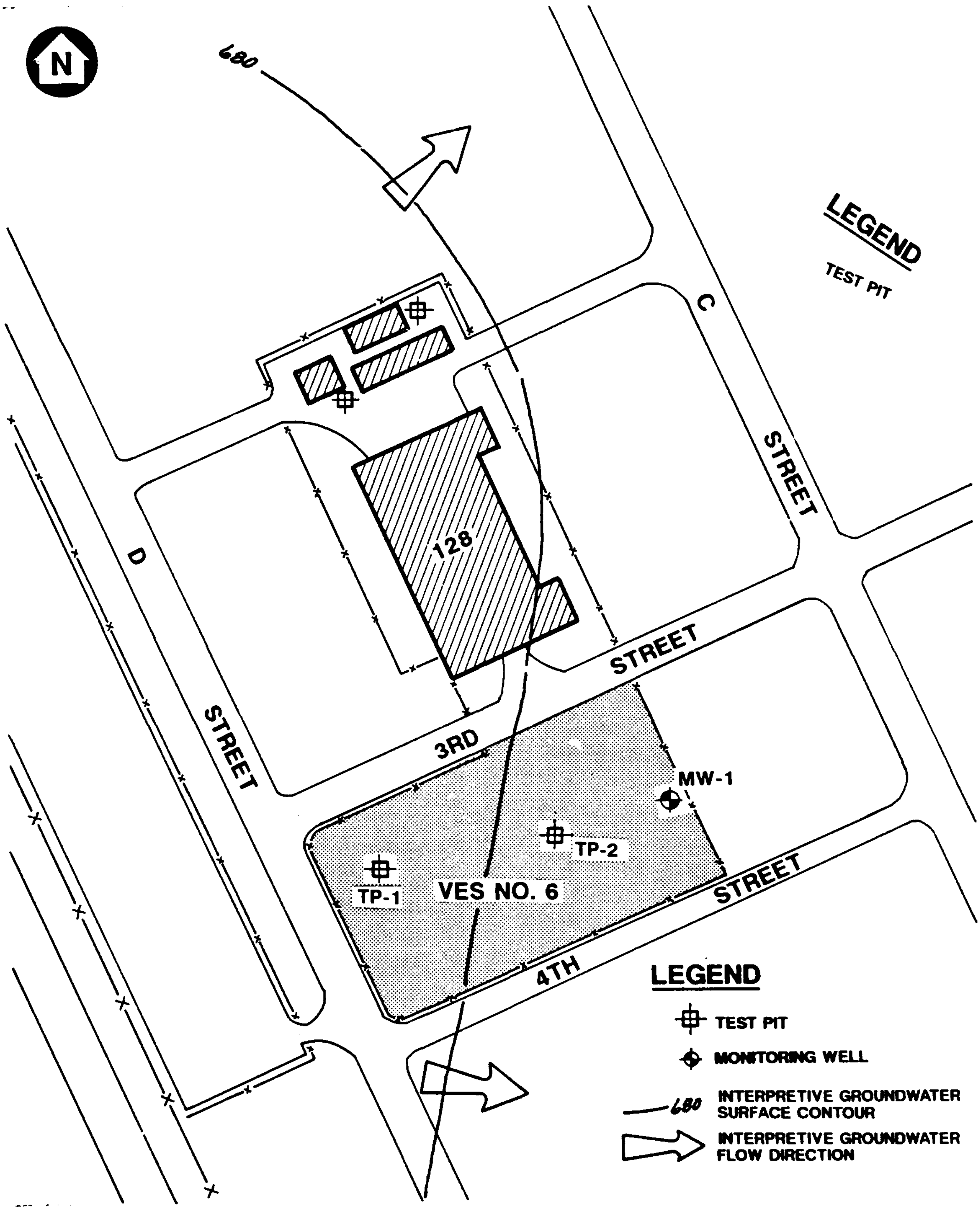

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FIGURE 5-20
VEHICLE AND EQUIPMENT STORAGE AREA NO. 6
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

Monitoring Well Installation. The monitoring well at VES-6 will provide groundwater quality information and provide a needed groundwater elevation monitoring point in this area. A 4-inch ID monitoring well will be installed in the borehole upon completion. The monitoring well will be constructed of flush-joint, threaded Schedule 40 PVC pipe and screen. The screen will be positioned to extend from approximately 2 feet above the water table to 8 feet below. The annulus around the wellscreen and at least 5 feet above the top of the screen, will be backfilled with clean silica sand. A minimum 5-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be equipped with a 5-foot-long steel protective casing with lock which extends approximately 2.5 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

Upon completion, the monitoring well will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, the well will be developed using block and surge techniques. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the well will be developed by purging five well volumes or an alternate method as approved by USATHAMA.

In-situ permeability tests will be conducted in the well to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

One round of groundwater samples will be collected at this site. Sampling will not occur sooner than 14 days following well development or permeability testing. Groundwater samples will be analyzed for TCL VOCs and SVOCs.

5.4.5 Vehicle and Equipment Storage Area No. 7

5.4.5.1 Site Description. In the 1952 aerial photograph of Fort Sheridan, VES No. 7 was an area of approximately 5 acres bounded by B, C, 3rd, and 9th streets. However, by 1962, it was limited to an area approximately half its initial size at the northern end of the site. After 1985, a new barracks (i.e., Building 574) was constructed at the site. Although there is no record of spills at the site, spills or leaks of POL or other hazardous substances may have occurred. EPIC identified ground-staining or possible ground-staining at VES No. 7 in aerial photographs from 1962, 1972, 1976, 1980, and 1981.

5.4.5.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize subsurface soils beneath the vehicle and equipment storage area

- investigate the hydraulic properties of shallow soils through visual observation of fractures within the till

5.4.5.3 Exploration and Sampling Program. Figure 5-21 shows the exploration locations at VES No. 7.

Test Pit Program. A minimum of three test pits will be dug at VES No. 7 to investigate surface and subsurface soils in areas where visible staining has been observed. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pit and visual observations from the edge of the test pit. Two analytical soil samples per test pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. The analytical soil samples should be collected from shallow soils (upper 5 feet) which are visibly stained and/or show elevated PID readings. The soil samples will be analyzed for TCL VOCs and SVOCs.

5.4.6 Vehicle and Equipment Storage Area No. 9

5.4.6.1 Site Description. Aerial photographs of Fort Sheridan from 1952, 1962, and 1972 identify VES No. 9 as an irregularly shaped parcel occupying most of the area south of Wells Ravine between Patten Road and 10th Street. In 1976, however, it appears as a much smaller, fenced area west of Building 642 and bordering 10th Street. The fence was still in place in October 1989. Although there is no record of spills at this site, spills or leaks of POL and other hazardous substances may have occurred. Old post maps identify Building 642 and an adjacent, but now demolished, building as motor repair areas. EPIC identified ground-staining at this site in aerial photographs from 1952, 1962, and 1972. This site is primarily a graveled area, although some portions do have a grass cover. The ground surface slopes gently to the north from 10th Street to Wells Ravine.

5.4.6.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize subsurface soils beneath the vehicle and equipment storage area
- investigate the hydraulic properties of shallow soils through visual observation of fractures within the till

5.4.6.3 Exploration and Sampling Program. Figure 5-22 shows the exploration locations at VES No. 9.

Test Pit Program. A minimum of four test pits will be required to investigate the VES No. 9 area, due to its larger size and proximity to Landfill No. 6. Two of the test pits will be located outside the fenced area, behind Building No. 642 and former Building No. 646 where EPIC noted surface staining. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pit and visual observations from the edge of the test pit. Two analytical soil samples per test pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. The analytical soil samples should be collected from shallow soils (upper five feet)

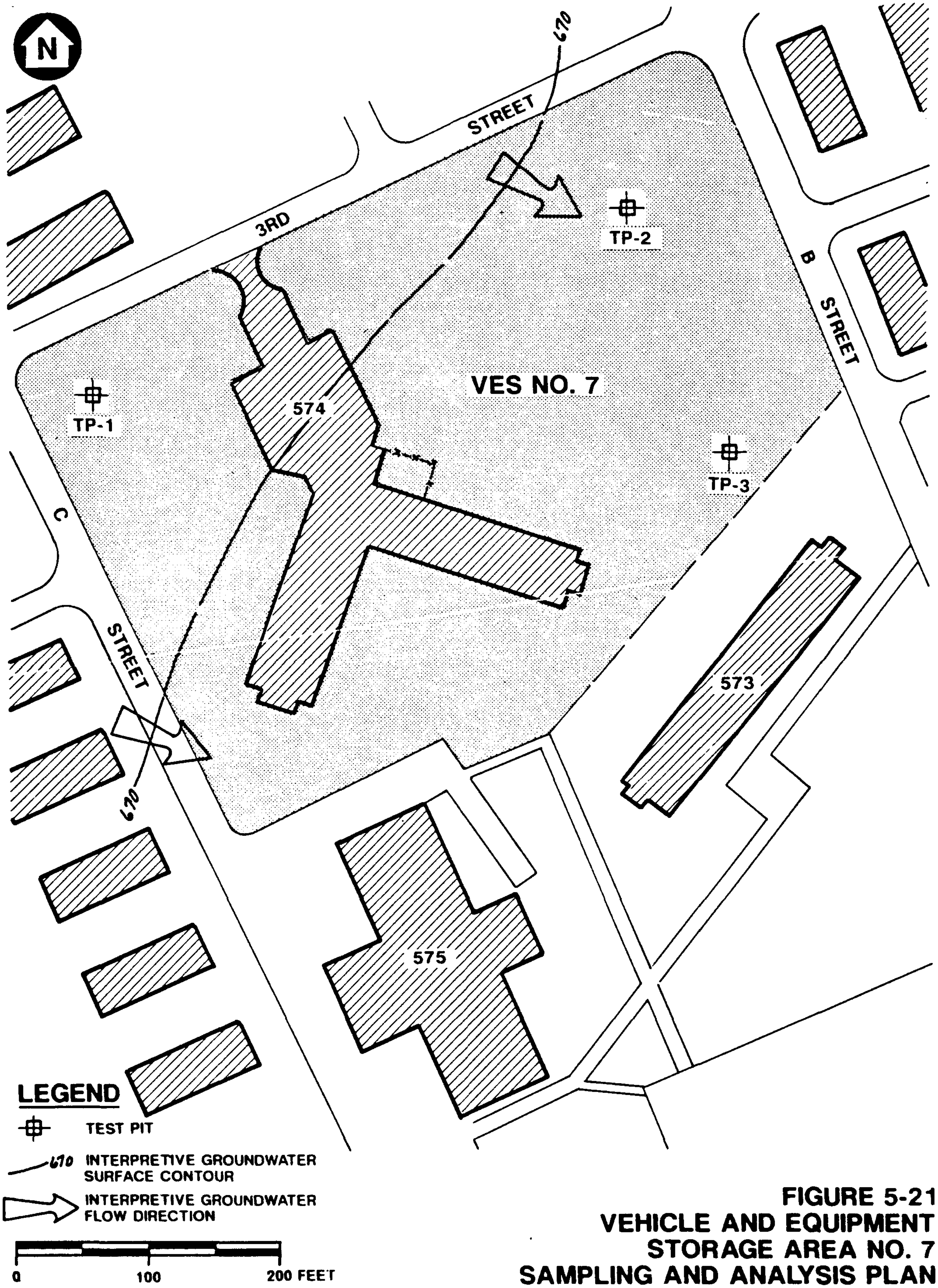

FIGURE 5-21
VEHICLE AND EQUIPMENT STORAGE AREA NO. 7
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

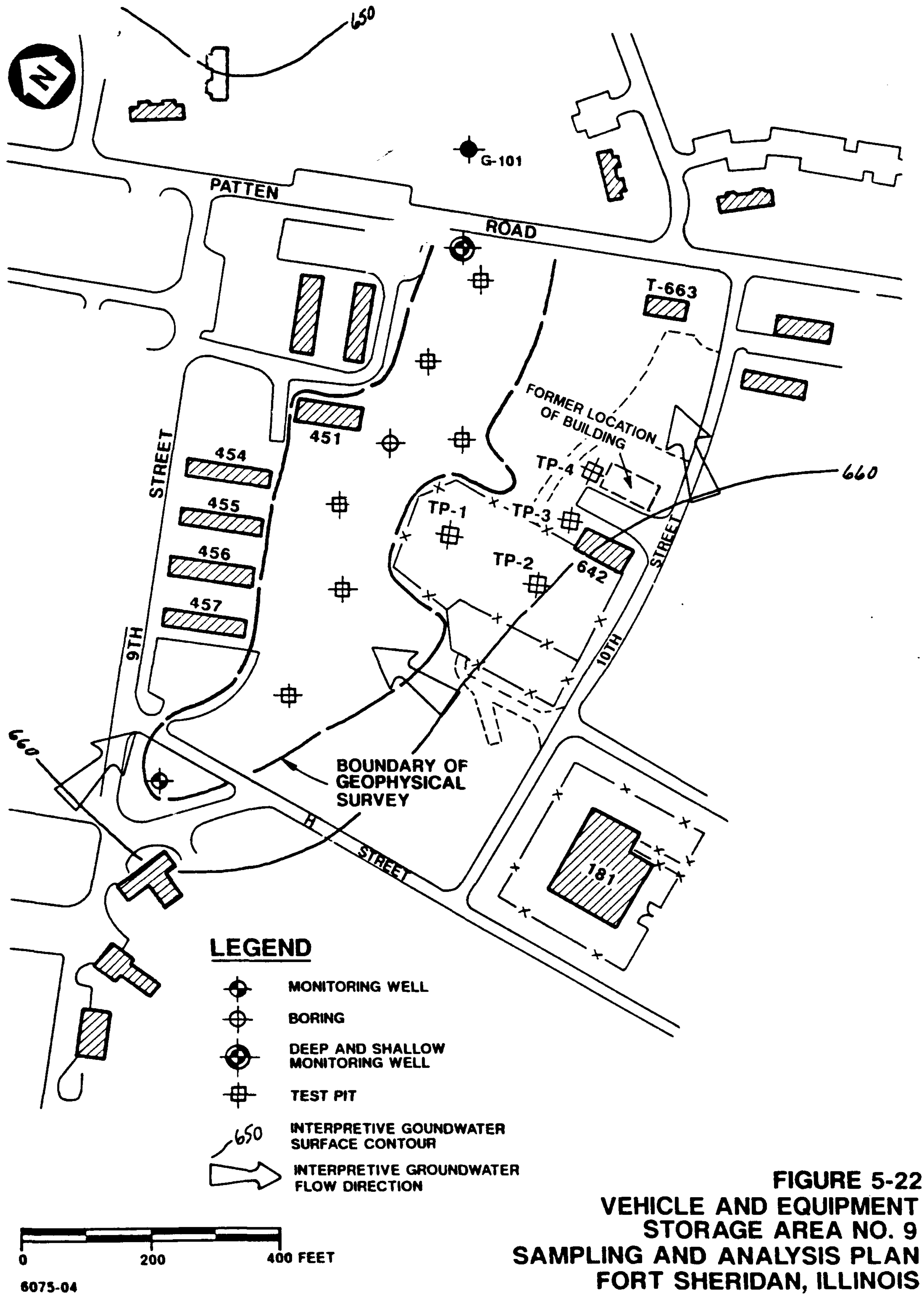

FIGURE 5-22
VEHICLE AND EQUIPMENT STORAGE AREA NO. 9 SAMPLING AND ANALYSIS PLAN FORT SHERIDAN, ILLINOIS

which are visibly stained and/or show elevated PID readings. The soil samples will be analyzed for TCL VOCs and SVOCs.

5.4.7 Storage Area at Building 122

5.4.7.1 Site Description. Aerial photographs from 1952 through 1985 identify the area between Buildings 70, 143, 144, 145, and 146 as an open storage area for assorted equipment and containers. Staining around containers was observed by EPIC in several of the photographs. Of special concern is the fact that a portion of this area near the current location of Building 122 was and is used for outside storage of out-of-service transformers, some of which have tested positively as containing PCBs. Although no spills or leaks of PCB-containing fluids are reported for this area, they may have occurred (Argonne National Laboratory, 1989). This area is now paved; however, storage activities, including transformer storage, predate the paving. This site slopes gently to the north and east.

5.4.7.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- o characterize surface soils at the site
- o investigate the hydraulic properties of shallow soils through visual observation of fractures within the till
- o obtain a chemical analysis of the floor staining

5.4.7.3 Exploration and Sampling Program. Because the site is paved, shallow borings are recommended as the investigative technique. Figure 5-23 shows the shallow soil sampling locations at Building 122.

Surface Soil Sampling. Two composite shallow soil samples will be collected from the area behind Building 122 where staining was observed by EPIC. A total of eight shallow (5-foot) soil borings will be completed to collect the soil samples. A jackhammer may be required to break up the asphalt pavement prior to test pitting. The analytical samples should be collected from shallow soils beneath the pavement which are visibly stained and/or show elevated PID readings. The soil samples will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, and elements.

5.4.8 Storage Area Behind Buildings 137X, 137, and 139

5.4.8.1 Site Description. The area behind (i.e., north of) Buildings 137X, 137, and 139 has been active as a storage area for assorted equipment and containers since at least 1952. In addition, the northwestern corner was part of Coal Storage Area No. 1. During a site visit in October 1989, ground-staining was evident next to battery and drum storage areas immediately adjacent to the buildings. Scattered stains were also evident throughout the area, except for a newly graveled section in the northwestern corner. This site has a gravel surface that slopes gently to the north.

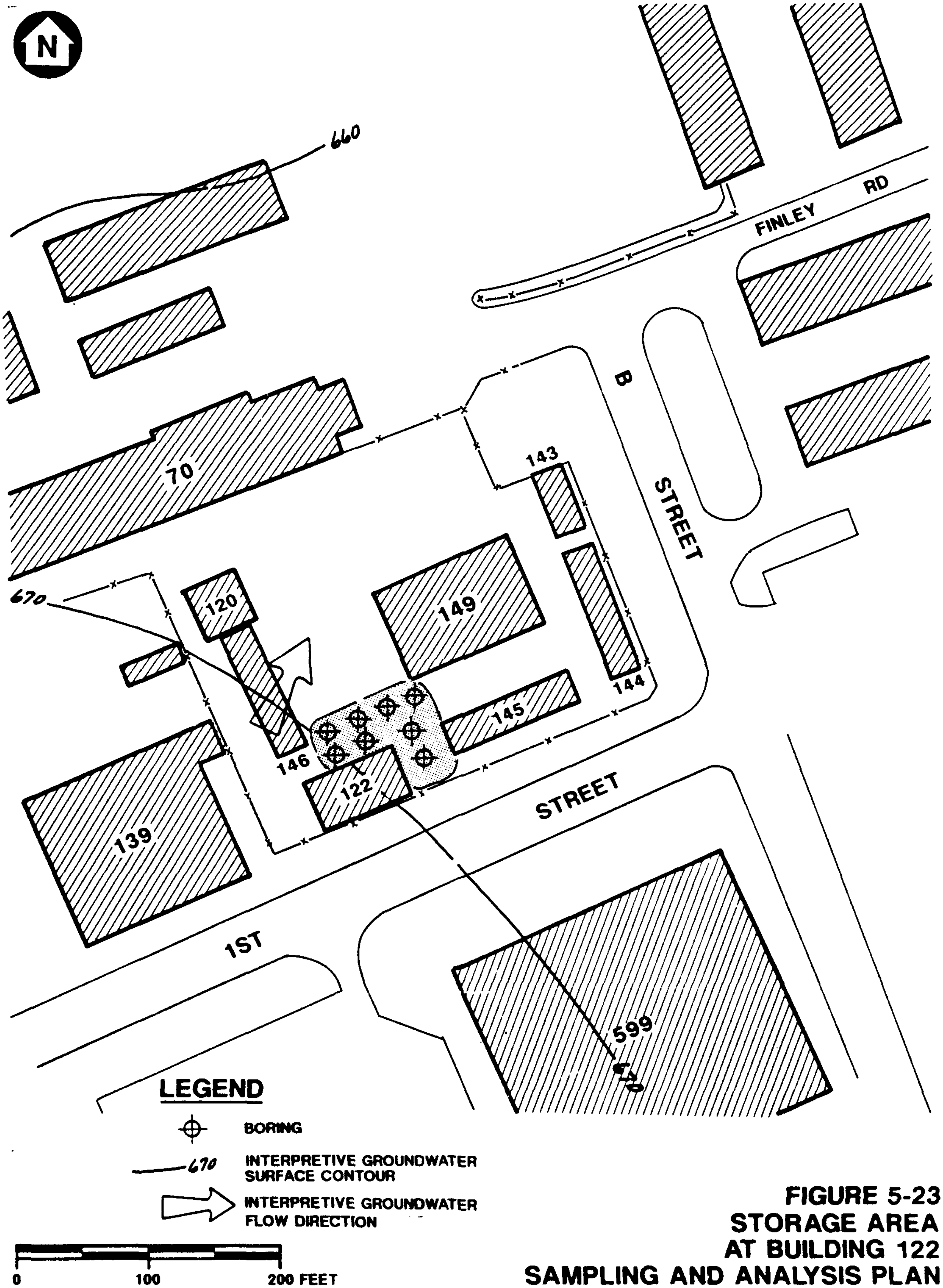

FIGURE 5-23
STORAGE AREA AT BUILDING 122
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

5.4.8.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize surface and subsurface soils at the site
- investigate the hydraulic properties of shallow soils through visual observation of fractures within the till

5.4.8.3 Exploration and Sampling Program. The area behind Buildings 137 and 139 is not paved and is actively used as a storage area. A total of four test pits will be completed in the storage area to investigate shallow soils. Figure 5-24 shows the exploration locations behind Buildings 137X, 137, and 139.

Test Pit Program. Four test pits will be dug in the storage area behind Buildings 137X, 137, and 139. One test pit will be located in the battery storage area and one in the drum storage area, both adjacent to the buildings. A third test pit will be located west of Building 137, where recent analyses of surface soil samples showed contamination with VOCs and SVOCs. The fourth test pit will be located where staining was observed during the October 1989 site visit. The test pits will be terminated at the water table, or at a maximum depth of 15 feet below ground surface. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pit and visual observations from the edge of the test pit. The analytical soil samples should be collected from shallow soils (upper five feet) which are visibly stained and/or show elevated PID readings. Soil samples will be screened in the field using a portable PID.

Based on the field screening results, an average of two soil samples from each test pit (eight samples for the site) will be submitted for laboratory analysis. The soil samples will be analyzed for TCL VOCs, SVOCs, and elements.

5.5 MISCELLANEOUS YARD AREAS

The draft Enhanced Preliminary Assessment identified six yard areas as being sites of known or suspected releases of hazardous substances. These yard areas are at Buildings 126, 128, 216, 368, 377, and 902. The site locations are shown in Figure 5-25. Table 5-10 summarizes the exploration programs and Table 5-11 summarizes the samping and analytical program for these yard areas.

5.5.1 Yard Area at Building 126

5.5.1.1 Site Description. In the past, the yard area at Building 126 was used to formulate some of the fertilizers and pesticides for maintaining the golf course and to clean up the equipment used for application. This activity occurred both before and after the yard was paved.

The area of concern around Building 126 is mostly paved, except for a grassed drainage ditch parallel to the northeastern side of the building. Runoff that collects in the ditch flows in a northeastern direction to Janes Ravine.

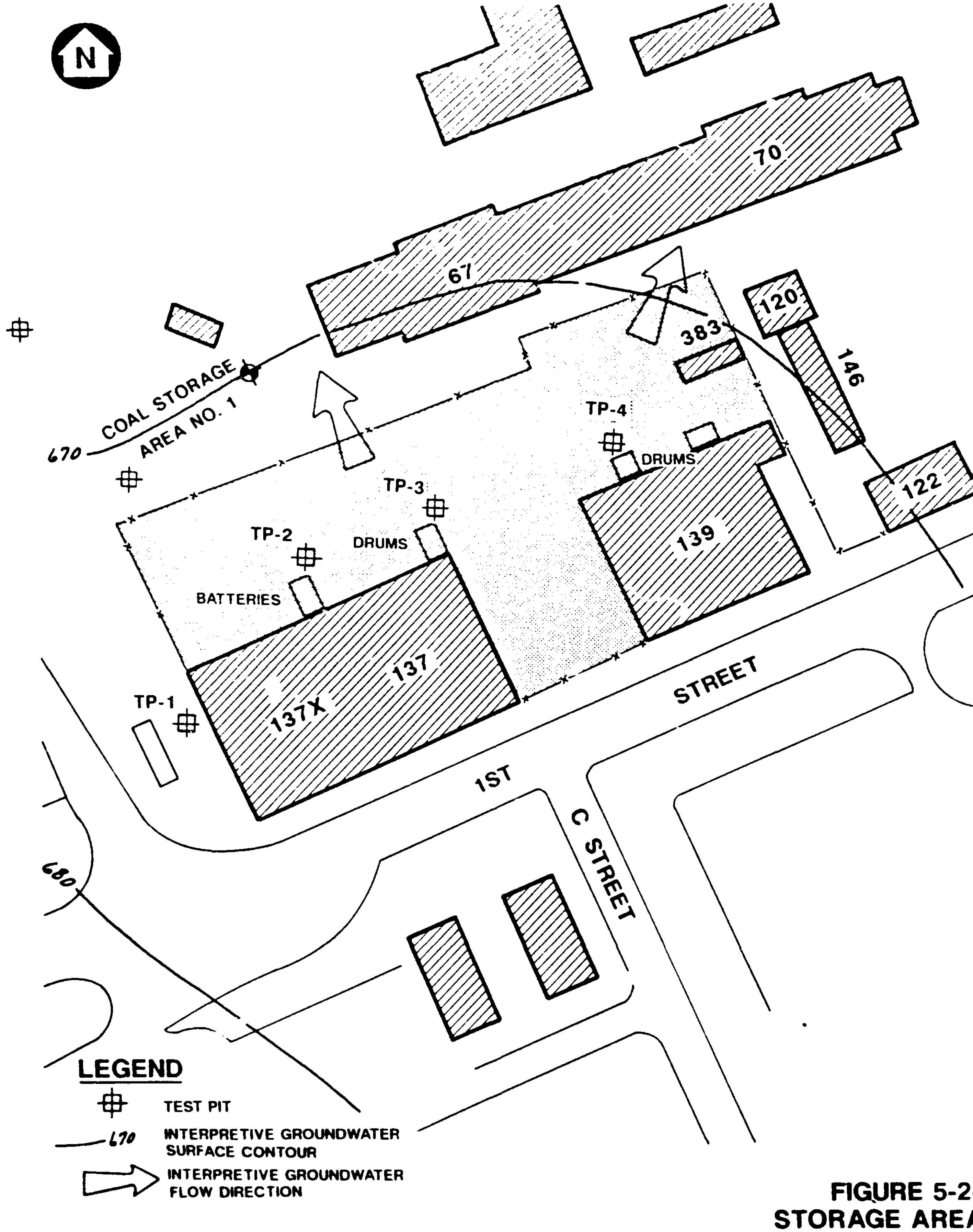

FIGURE 5-24
STORAGE AREA
BEHIND BUILDINGS 137X, 137, AND 139
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

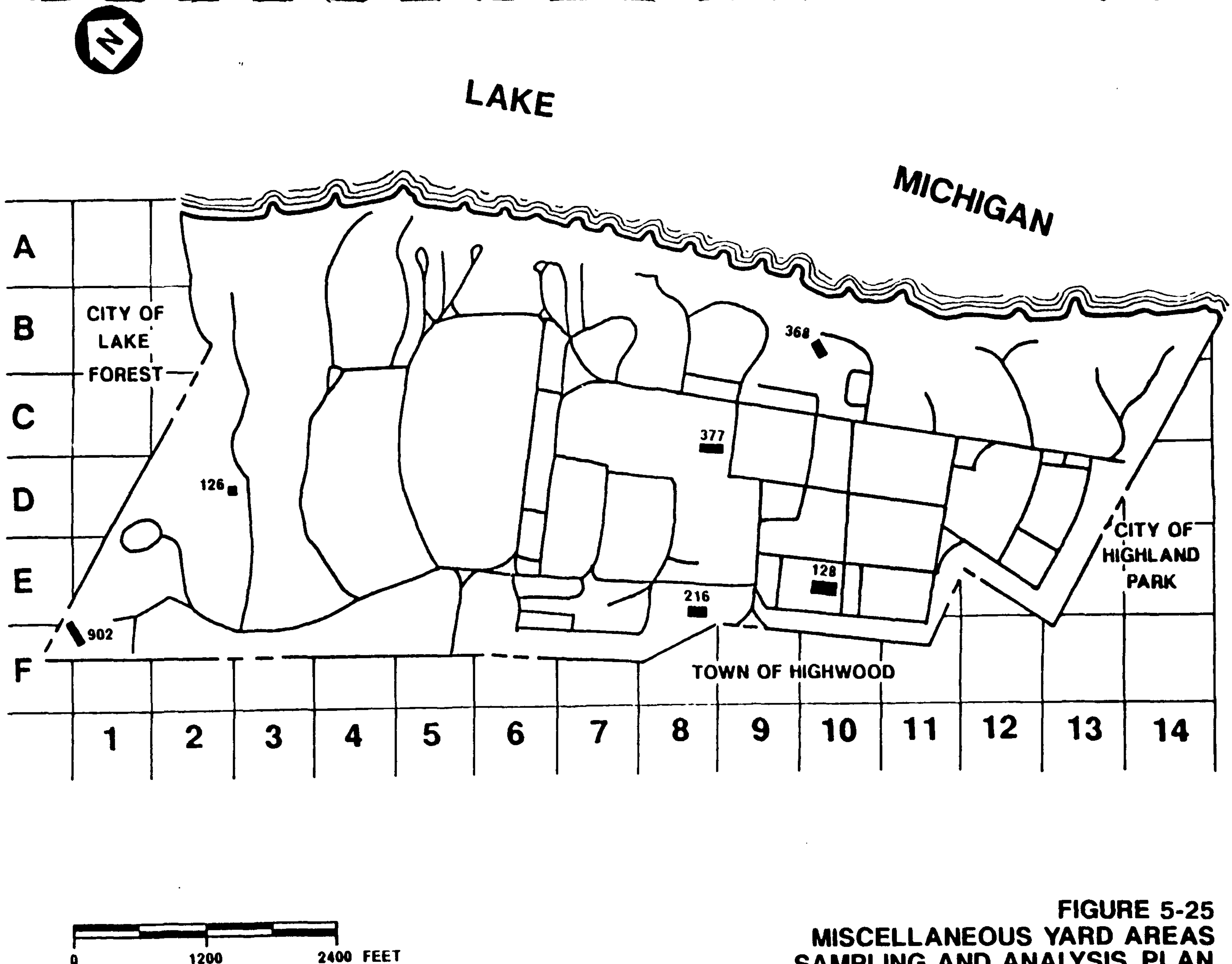

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FIGURE 5-25
MISCELLANEOUS YARD AREAS
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

TABLE 5-10
BACKHOE, DRILLING AND MONITORING WELL SUMMARY
FOR YARD AREAS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

EXPLORATION/SITE	NO. OF EXPLORATIONS	TOTAL DEPTH OF EXPLORATIONS (L.F.)	DEPTH TO GWT (FT.)	NO. OF SPLIT-SPOON SAMPLES CONT. (NO.)	NO. OF SPLIT-SPOON SAMPLES 5-FOOT (NO.)	PVC SCREEN (L.F.)	PVC RISER (L.F.)	BENT. PELLET SEAL (L.F.)	CLAY GROUT (L.F.)	PROTECTIVE WELL CASING	55-GALLON DRUMS	WELL DEVEL. (HRS)
Test Pits												
Yard Area at Building 126	2	30	15	--	--	--	--	--	--	--	--	--
128	2	30	15	--	--	--	--	--	--	--	--	--
216	1	15	15	--	--	--	--	--	--	--	--	--
368	2	30	15	--	--	--	--	--	--	--	--	--
377	2	30	15	--	--	--	--	--	--	--	--	--
Soil Borings												
Yard Area at Building 126	--	--	--	--	--	--	--	--	--	--	--	--
128	--	--	--	--	--	--	--	--	--	--	--	--
216	--	--	--	--	--	--	--	--	--	--	--	--
368	1	25	15	--	--	--	--	--	--	--	--	--
377	--	--	--	--	--	--	--	--	--	--	--	--
Soil Borings with Monitoring Wells												
Yard Area at Building 126	1	25	15	12	--	10	15	5	3	1	2	12
128	--	--	--	--	--	--	--	--	--	--	--	--
216	--	--	--	--	--	--	--	--	--	--	--	--
368	2	50	15	12	5	20	30	10	6	2	3	24
377	1	25	15	12	--	10	15	5	3	1	2	12

TABLE 5-11
SUMMARY OF ANALYTICAL SAMPLING PROGRAM FOR YARD AREAS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

			NUMBER OF SAMPLES TCL ANALYTICAL SERIES				
SITE AND EXPLORATION TYPE	NUMBER OF EXPLORATIONS	MEDIA	VOC	SVOC	ELEMENTS	PESTICIDES/PCBs	HERBICIDES
Building 126							
Test Pits	2	Soil	--	--	4	4	4
Borings	1	Soil	--	--	3	3	3
Monitoring Wells	1	Water	--	--	1	1	1
Building 128							
Test Pits	2	Soil	4	4	--	--	--
Building 216							
Test Pits	1	Soil	--	--	2	--	--
Building 368							
Test Pits	2	Soil	4	4	--	--	--
Borings	3	Soil	9	9	--	--	--
Monitoring Wells	2	Water	2	2	--	--	--
Building 377							
Test Pits	2	Soil	--	4	4	4	4
Borings	1	Soil	--	3	3	3	3
Monitoring Wells	1	Water	--	1	1	1	1
Building 902							
Test Pits	4	Soil	8	8	--	--	--
Total Soil Samples			25	32	17	14	14
Total Water Samples			2	3	2	2	2

5.5.1.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize surface and subsurface soils in the area where pesticides were formulated

- investigate nature and extent of fractures and hydraulic properties of the native till, based on visual observations, in-situ permeability tests, and water level measurements.

- characterize downgradient shallow groundwater quality

5.5.1.3 Exploration and Sampling Program. Figure 5-26 shows the exploration locations for the Yard Area at Building 126.

Test Pit Program. A minimum of two test pits will be dug in the area outside Building 126. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pit and visual observations from the edge of the test pit. Soil samples will be screened in the field using a PID. Two soil samples per test pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. One of the soil samples per pit will be collected within 1 foot of ground surface. The soil samples will be analyzed for TCL pesticides, elements, and herbicides.

Soil Boring Program. One soil boring will be installed downgradient of the wash area at Building 126 to characterize soils and groundwater quality from this area. The proposed location is shown in Figure 5-26. The actual location of the boring may be adjusted in the field based on the findings of the test pit investigation. The boring will be completed as a shallow boring, estimated to be 25 feet in depth, approximately 10 feet below the water table. The boring will be sampled continuously, using split-spoon samplers. Soil samples will be screened in the field using a portable PID. If elevated PID readings are detected in the soils from the bottom of the borehole, the borehole will be advanced further, until a minimum of two split-spoon soil samples shows no elevated PID levels. If the resultant borehole is more than 3 feet below the anticipated bottom of the monitoring well screen, the bottom of the borehole will be grouted with a high solids bentonite grout up to 3 feet from the expected bottom of the screen. (See the QAPP, Data Item A0006 for a description of grouting procedures and specifications).

Based on the field screening results, three soil samples from the boring will be submitted for laboratory analysis. The soil samples from the boring will be analyzed for TCL elements, pesticides, and herbicides.

Monitoring Well Installation. The monitoring well at VES-6 will provide groundwater quality information and provide a needed groundwater elevation monitoring point in this area. A 4-inch I.D. monitoring well will be installed in the borehole upon completion. The monitoring well will be constructed of flush-joint, threaded Schedule 40 PVC pipe and screen. The screen will be positioned to extend from approximately two feet above the water table to 8 feet

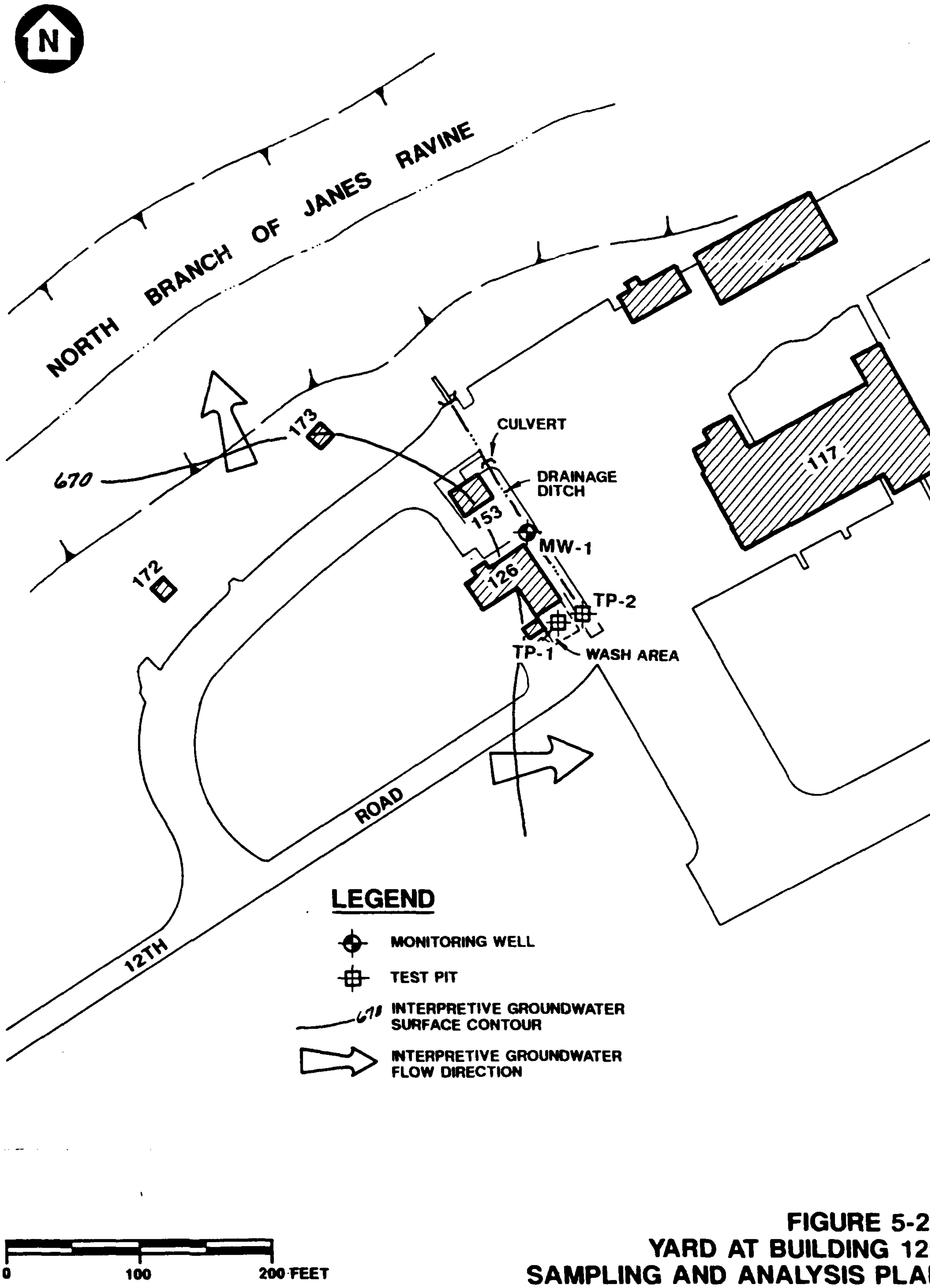

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FIGURE 5-26
YARD AT BUILDING 126
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

below. The annulus around the wellscreen and at least 5 feet above the top of the screen, will be backfilled with clean silica sand. A minimum 5-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be equipped with a 5-foot long steel protective casing with lock which extends approximately 2.5 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

Upon completion, the monitoring well will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, the well will be developed using block and surge techniques. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the well will be developed by purging five well volumes or an alternate method as approved by USATHAMA.

In-situ permeability tests will be conducted in the well to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

One set of groundwater samples separated by a minimum of 14 days will be collected at this site. Sampling will not occur sooner than 14 days following well development or permeability testing. The groundwater sample will be analyzed for TCL elements, pesticides, and herbicides.

5.5.2 Yard Area at Building 128

5.5.2.1 Site Description. This building, designated AMSA #47, was remodeled in 1976 and is used for vehicle maintenance, including oil changes and similar service. Prior to that time, it was the location for electronics maintenance and, most significantly, the NIKE regional service center (Argonne National Laboratory, 1989).

Adjacent to Building 128 is a waste material storage area. Approximately 100 gallons per month of oil are accumulated in an aboveground 500-gallon tank. Solvents, antifreeze, and similar materials are segregated in 55-gallon drums placed on wooden pallets on top of gravel adjacent to the oil tank.

Next to this waste storage area is a partially curbed wash pad, which drains to an oil/water separator. The wash pad and the area beneath the storage drums were stained with oil. Because of the possibility of soil and groundwater contamination, this area has been included in the RI.

5.5.2.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize surface and subsurface soils around the aboveground tank and 55-gallon drum storage area and adjacent to the wash pad
- investigate nature and extent of fractures in the native till, based on visual observations

5.5.2.3 Exploration and Sampling Program. Figure 5-27 shows the exploration locations for the Yard Area at Building 128.

Test Pit Program. A minimum of two test pits will be dug in the area outside Building 128. One test pit will be located adjacent to the aboveground 500-gallon waste oil tank and extend to the area where the 55-gallon drums are stored. Staining was noted beneath the drum storage area. The second test pit will be located adjacent to the wash pad which was also stained with oil. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated material from the test pit and visual observation from the edge of the test pit. Two soil samples per test pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. One analytical soil sample will be collected within one foot and one within five feet of ground surface. The soil samples will be analyzed for TCL VOCs and SVOCs.

5.5.3 Sandblasting Area at Building 216

5.5.3.1 Site Description. Building 216 houses the Allied Trades Body Shop. The activities performed include body work and painting of automotive vehicles and other equipment. A sandblasting operation, using non-silica grit, is located outdoors on a graveled area at the southern end of the building.

5.5.3.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize surface and subsurface soils around the sandblasting area
- investigate nature and extent of fractures in the native till, based on visual observations

5.5.3.3 Exploration and Sampling Program. Figure 5-28 shows the exploration locations for the Yard Area at Building 216.

Test Pit Program. At least one test pit will be dug where sandblasting activities occurred and where metal and paint dust may have been deposited. The test pit will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pit will be logged by the field geologist based on excavated materials from the test pit, and visual observation from the edge of the test pit. Two analytical soil samples, one of which is from the upper 1-foot,. will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. The soil samples will be analyzed for TCL elements.

5.5.4 Yard Area at Auto Craft Shop, Building 368

5.5.4.1 Site Description. The Auto Craft Shop, or Hobby Shop, is located in Building 368. It is open to installation personnel most weekday afternoons and evenings, as well as Saturdays, for maintenance of personal vehicles. Five work bays and a wash area are available for use. The area is bordered on three sides by an asphalt parking area, and on the fourth by a grassed area. There is a

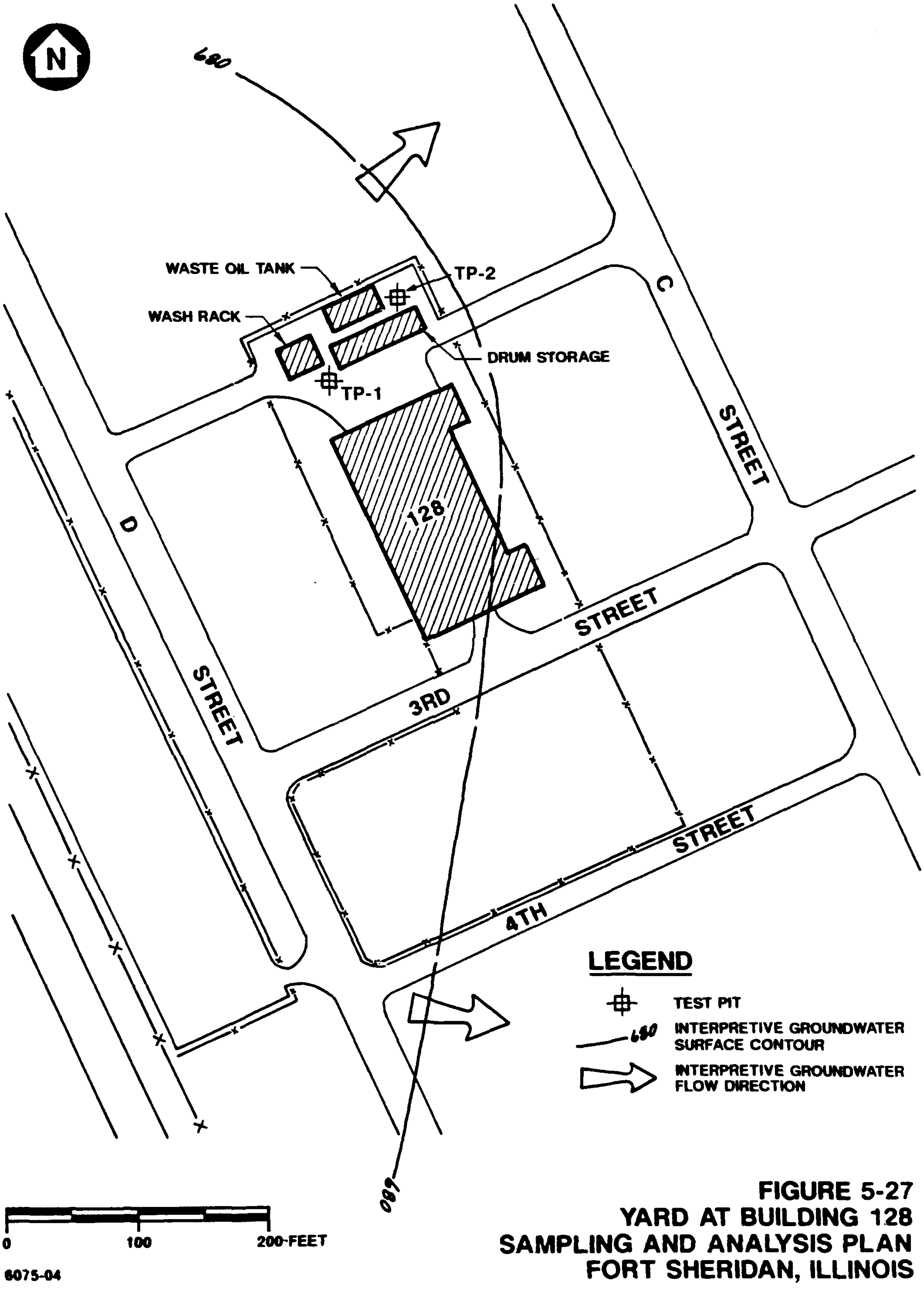

FIGURE 5-27
YARD AT BUILDING 128
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

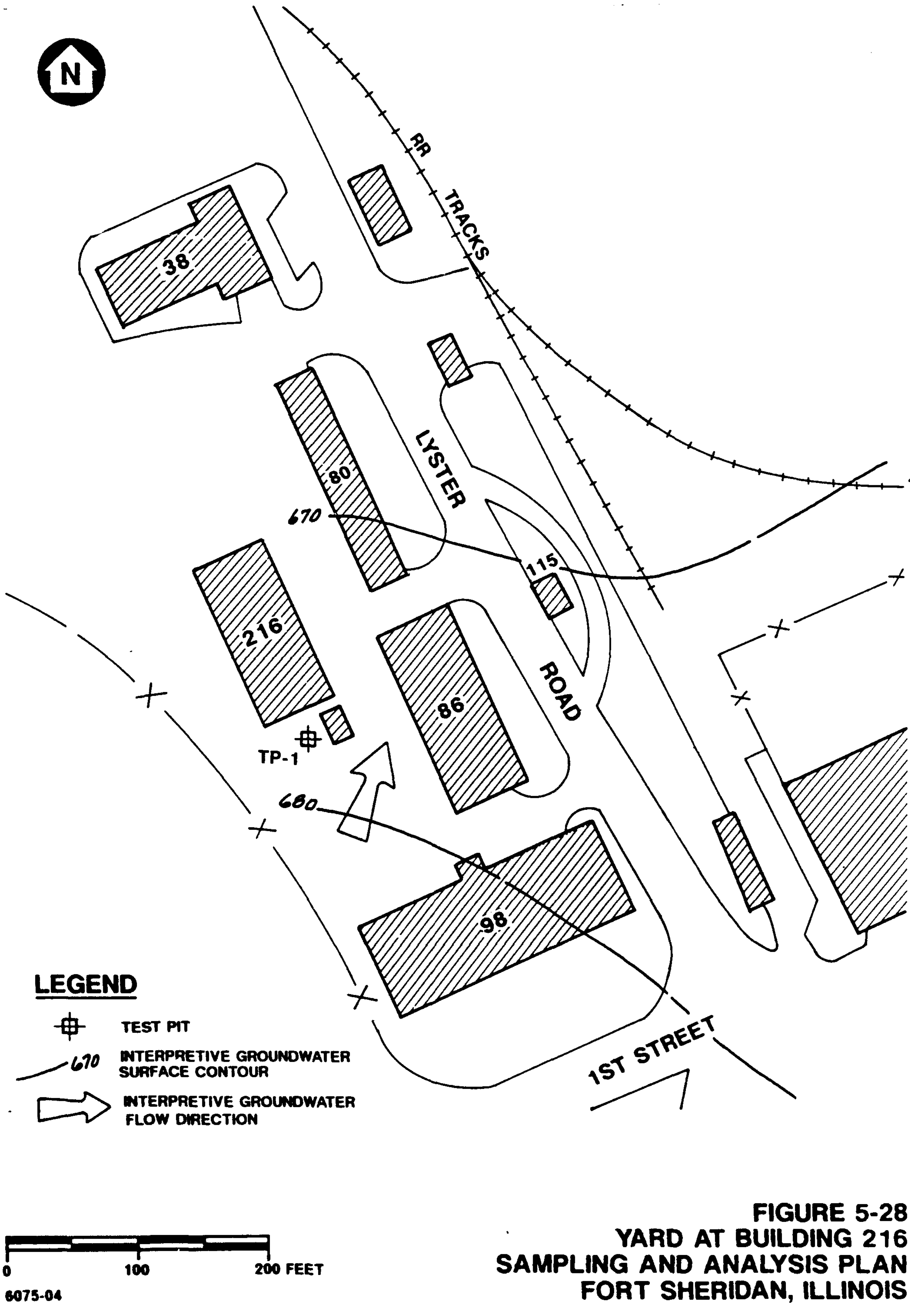

FIGURE 5-28
YARD AT BUILDING 216
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

locked, fenced area behind the building that contains a fuel tank with an approximate 500-gallon capacity and several 55-gallon drums. A waste fluid disposal area discolored with oil stains is located on asphalt outside the fenced area.

The wash area inside the shop drains to a shallow, grassed drainage ditch adjacent to the building. Staining has been observed in the ditch and oily sludge in a storm drain located in the ditch.

This site slopes gently to the northwest; runoff flows in that direction toward Van Horne Ravine. The ravine is located immediately behind the fenced area and approximately 100 to 150 feet behind Building 368. The shallow grassed ditch next to the building discharges to the ravine.

5.5.4.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize surface and subsurface soils around the work bays and wash area

- investigate shallow groundwater quality downgradient of the craft shop

- investigate nature and extent of fractures in the native till, based on in-situ permeability tests and visual observations

- confirm the presence or absence of any oil-water separators that currently serve or in the past served Building 368 and that may leak or overflow

5.5.4.3 Exploration and Sampling Program. Figure 5-29 shows the exploration locations at the Auto Craft Shop, Building 368.

Test Pit Program. A minimum of two test pits will be dug along the side of Building 368, outside the fenced area. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pit, and visual observation from the edge of the test pit. Two analytical soil samples per pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. The soil samples will be analyzed for TCL VOCs and SVOCs.

Soil Boring Program. Building 368 is located in an area where groundwater flows radially outwards to the north and Van Horne Ravine and to the east toward Lake Michigan. Therefore, three soil borings will be completed and two will be equipped with monitoring wells. All of the borings will be completed as shallow borings, and are estimated to be 25 feet in depth, approximately 10 feet below the water table. One of the borings will be sampled continuously, using a split-spoon sampler. The others will be sampled at 5-foot intervals or more frequently at stratigraphic changes. Soil samples will be screened in the field using a portable PID. Based on the field screening results, an average of three soil samples per boring will be submitted for laboratory analysis. The soil samples will be analyzed for TCL VOCs and SVOCs.

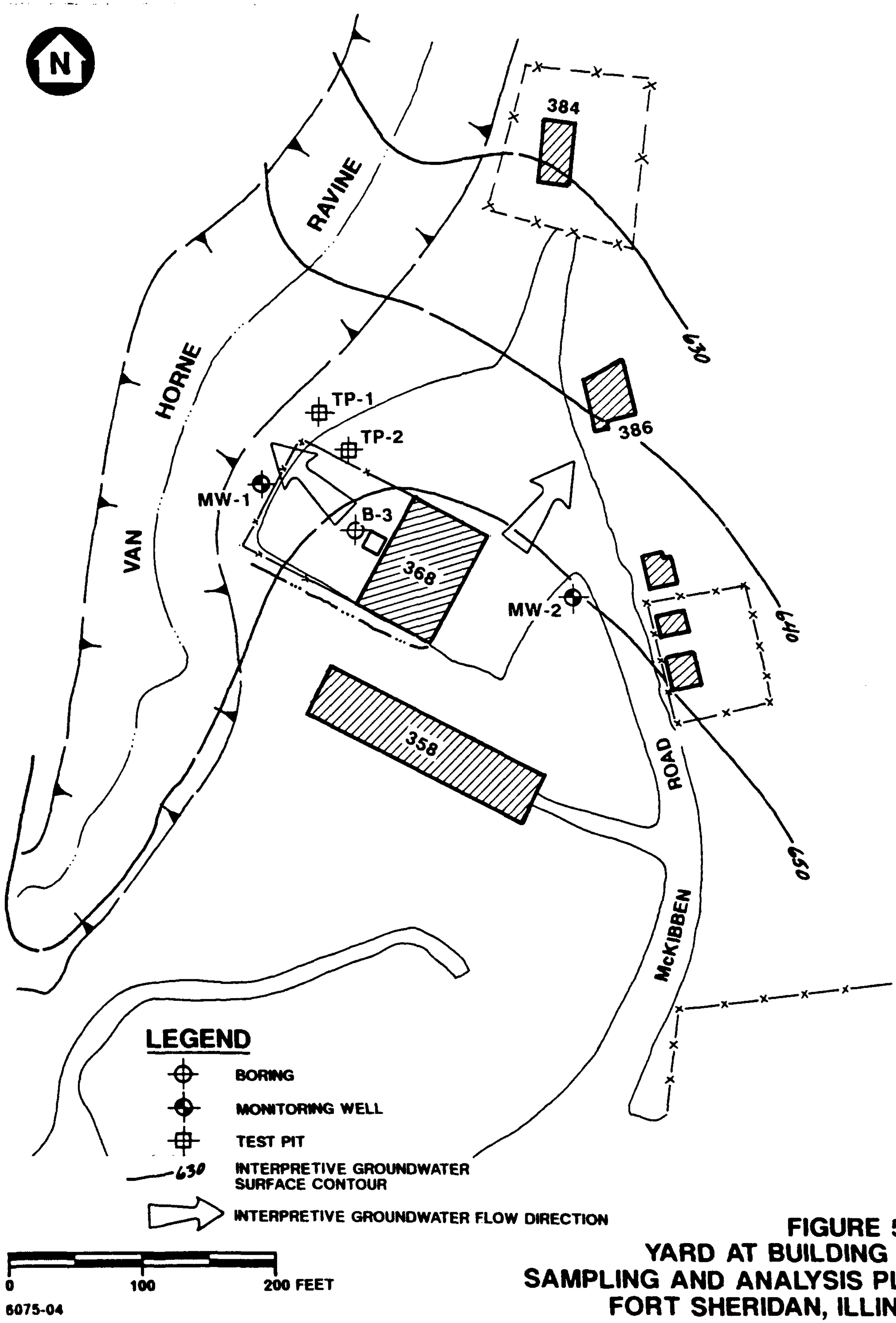

FIGURE 5-29
YARD AT BUILDING 368
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

Monitoring Well Installation. A 4-inch ID monitoring well will be installed in two of the boreholes upon completion. The monitoring wells will be constructed of Schedule 40, flush-joint, threaded PVC pipes and screen. The screens will be positioned to extend from approximately 2 feet above the water table to 8 feet below. The annulus around the wellscreen and at least 5 feet above the top of the screen, will be backfilled with clean silica sand. A minimum 5-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be equipped with a 5-foot-long steel protective casing with lock which extends approximately 3 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

Upon completion, the monitoring wells will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, wells will be developed using block and surge techniques. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the wells will be developed by purging five well volumes or an alternate method as approved by USATHAMA.

In-situ permeability tests will be conducted in a minimum of one well to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

One set of groundwater samples will be collected at this site from each of the monitoring wells. Sampling will not occur sooner than 14 days following well development or permeability testing. Groundwater samples will be analyzed for TCL VOCs and SVOCs.

Site Observations. Investigate the presence of oil-water separations at this site.

5.5.5 Yard Area at Building 377

5.5.5.1 Site Description. Argonne reports that all pesticides used by the Directorate of Engineering and Housing have long been stored in Building 377 (Argonne National Laboratory, 1989). Building 377 is also the site where chemicals are mixed, if required, and where application equipment is prepared and cleaned. Until 1987, mixing, formulating, and wash-up was done on the graveled yard in front of the building. Subsequent to that time, the wash area was upgraded by construction of a curbed concrete pad. However, a drain at the center of the pad was not completed. As a result, the pad overflows to the adjacent graveled yard. Surface runoff flows northwesterly, parallel to Building 377 to a storm drain just as it did before the pad was installed.

5.5.5.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- o characterize surface and subsurface soils adjacent to the pesticide mixing area

- investigate shallow groundwater quality downgradient of the pesticide mixing area
- investigate nature and extent of fractures in the native till, based on in-situ permeability tests and visual observations

5.5.5.3 Exploration and Sampling Program. Figure 5-30 shows the exploration locations for the Yard Area at Building 377.

Test Pit Program. A minimum of two test pits will be dug along the downgradient sides (north and east) of the concrete wash pad area. The test pits will be extended the length of the wash pad on each side. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist and two soil samples per pit will be submitted for laboratory analysis. One soil sample per pit will be collected from the ground surface. The soil samples will be analyzed for TCL SVOCs, pesticides, elements, and herbicides.

Soil Boring Program. One soil boring will be installed downgradient of the wash pad to characterize soils and groundwater. The proposed location is shown in Figure 5-30. The actual location of the boring may be adjusted in the field based on the findings of the test pit investigation. The boring will be completed as a shallow boring, estimated to be 25 feet in depth, approximately 10 feet below the water table. The boring will be sampled continuously, using split-spoon samplers. Soil samples will be screened in the field using a portable PID. If elevated PID readings are detected in the soils from the bottom of the borehole, the borehole will be advanced further, until a minimum of two split-spoon soil samples shows no elevated PID levels. If the resultant borehole is more than 3 feet below the anticipated bottom of the monitoring well screen, the bottom of the borehole will be grouted with a high solids bentonite grout up to 3 feet from the expected bottom of the screen. (See the QAPP, Data Item A0006 for a description of grouting procedures and specifications).

Based on the field screening results, three soil samples from the boring will be submitted for laboratory analysis. The soil samples from the boring will be analyzed for TCL SVOCs, pesticides, elements, and herbicides.

Monitoring Well Installation. The monitoring well at this site will provide groundwater quality information and provide a needed groundwater elevation monitoring point in this area. A 4-inch ID monitoring well will be installed in the borehole upon completion. The monitoring well will be constructed of flush-joint threaded Schedule 40 PVC pipe and screen. The screen will be positioned to extend from approximately 2 feet above the water table to 8 feet below. The annulus around the wellscreen and at least 5 feet above the top of the screen, will be backfilled with clean silica sand. A minimum 5-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be equipped with a 5-foot-long steel protective casing with lock which extends approximately 2.5 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

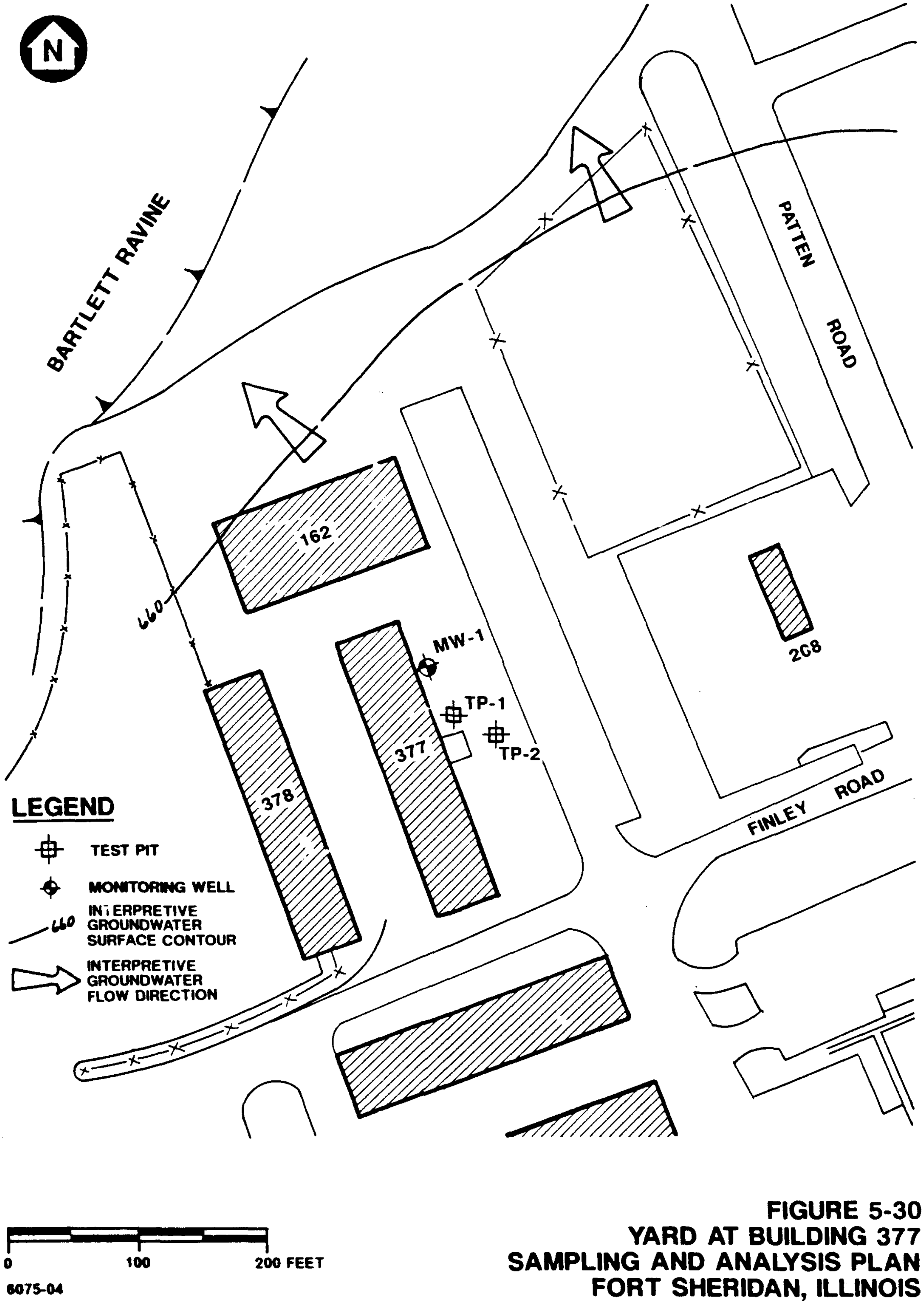

FIGURE 5-30
YARD AT BUILDING 377
SAMPLING AND ANALYSIS PLAN
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Upon completion, the monitoring well will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, the well will be developed using block and surge techniques. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the well will be developed by purging five well volumes or an alternate method as approved by USATHAMA.

In-situ permeability tests will be conducted in the well to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

One set of groundwater samples will be collected at this site. Sampling will not occur sooner than 14 days following well development or permeability testing. The groundwater sample will be analyzed for TCL SVOCs, pesticides, and herbicides.

5.5.6 Yard Area at Building 902

5.5.6.1 Site Description. Building 902 houses vehicle maintenance facilities for five reserve units. Light vehicle maintenance, such as oil changing and related service, is a typical weekend training activity. The building is largely unused except at that time. Each of the reserve units is assigned a portion of the building for storage; five work bays are available for use. The building has no floor drains. Approximately 150 vehicles are assigned to this Reserve Center.

Adjacent to Building 902 is a work ramp and a curbed concrete wash pad. Both have drains linked to an oil-water separator; however, according to facility personnel, the drain system has recently been malfunctioning (Argonne National Laboratory, 1989). Reportedly, the drains overflow when a moderate-to-heavy rain occurs.

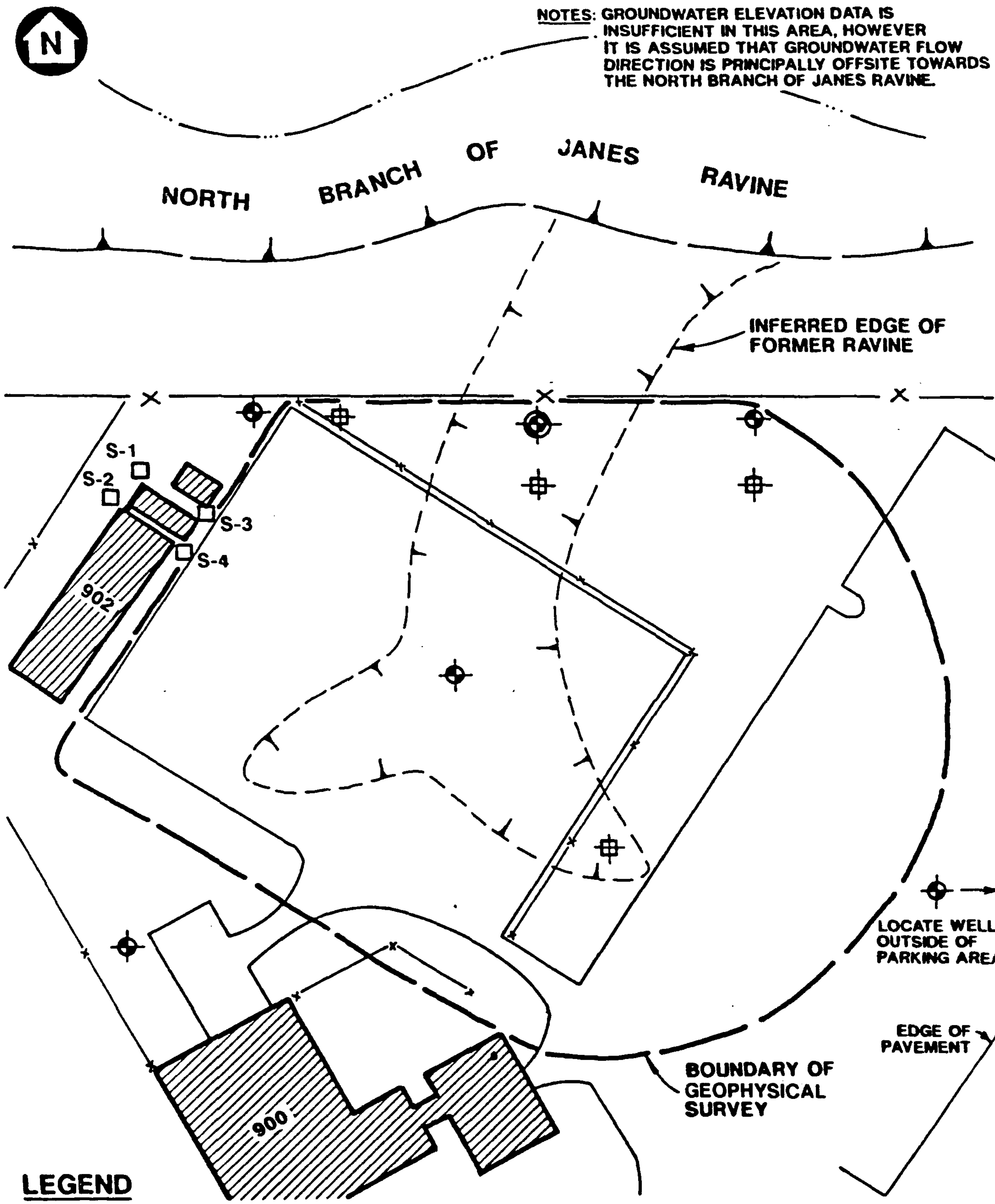
Surrounding the Building 902 maintenance facility is a large parking area for vehicle storage. Storm drainage flow from both the wash pad area and parking area is collected in a catch basin at the eastern corner of the paved area and flows through a storm sewer to the southern branch of Janes Ravine.

5.5.6.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize surface and subsurface soils adjacent to the work ramp and wash pad area

- investigate nature and extent of fractures in the native till, based on visual observations

5.5.6.3 Exploration and Sampling Program. Figure 5-31 shows the exploration locations behind Building 902.



LEGEND

☐ SURFACE SOIL SAMPLE

NOTE: GROUNDWATER FLOW DIRECTIONS IN THIS AREA ARE UNKNOWN

FIGURE 5-31
YARD AT BUILDING 902
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

6075-04

Test Pit Program. Surface and shallow soil samples will be collected from a minimum of two test pits dug around the work ramp and wash pad area. A jackhammer may be required prior to testpitting to remove the paving. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist based on excavated materials from the test pit and visual observations made from the edge of the test pit. Two analytical soil samples per pit will be collected from the center of the backhoe bucket using a stainless steel sampling spoon. One soil sample per pit will be collected from just below the pavement. The soil samples will be analyzed for TCL VOCs and SVOCs.

5.6 BUILDINGS

Six buildings warrant RI programs to determine whether hazardous substances have contaminated buildings. RI programs are described for Buildings Nos. 43, 70, 122, 137/139, 142, and 361. Site locations are shown in Figure 5-32. Table 5-12 summarizes the sampling and analytical programs.

5.6.1 Building 43

5.6.1.1 Site Description. Building 43 contains the General Support Shop, which includes furniture cleaning and stripping activities. The shop uses a commercial water-rinsable stripper typically containing methylene chloride and methanol to remove old finish from furniture. The bulk of the stripper is removed from the furniture with steel wool and scrapers, and disposed of off-site. However, some of the stripper is washed off the furniture with water. The wash water is collected in a floor drain, passing through a chemical separator system located outside the building before being discharged to Bartlett Ravine through a storm sewer.

5.6.1.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize discharge from the chemical separator
- investigate surface soil samples at the location where the chemical separator discharge enters Bartlett Ravine

5.6.1.3 Exploration and Sampling Program. Figure 5-33 shows the sampling locations at Building 43.

Discharge Sampling. One sample of the discharge/effluent from the chemical separator will be collected and analyzed for TCL VOCs and SVOCs.

Surface Soil Sampling. A minimum of two composite soil samples will be collected from the location where the chemical separator discharge enters Bartlett Ravine. The samples will be collected from areas where staining is observed, or where the effluent impacts the ground surface.

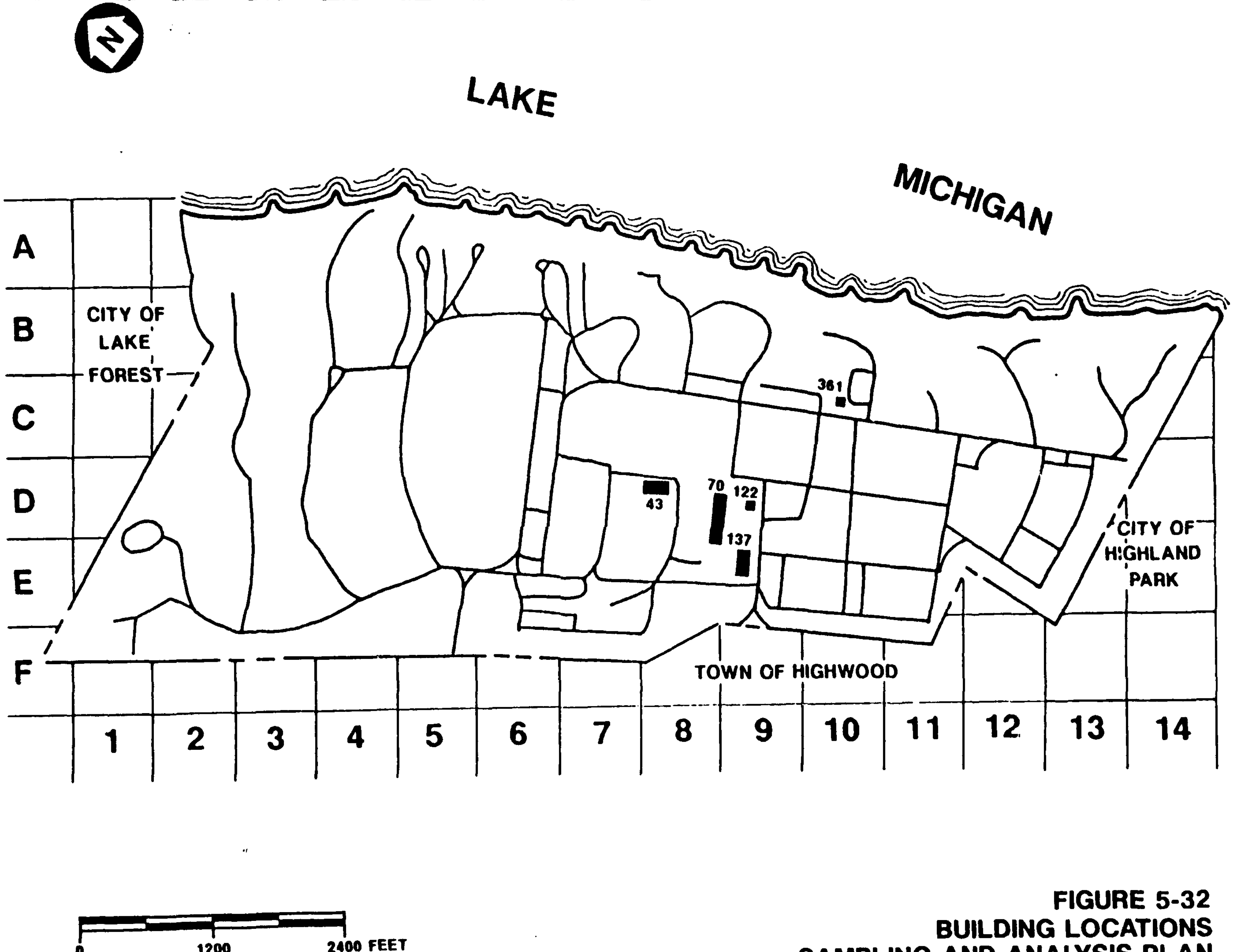


FIGURE 5-32
BUILDING LOCATIONS
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

6075-04

TABLE 5-12
SUMMARY OF ANALYTICAL SAMPLING PROGRAM FOR BUILDINGS

SAMPLING AND ANALYSIS PLAN
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SITE AND EXPLORATION TYPE	NUMBER OF EXPLORATIONS	MEDIA	NUMBER OF SAMPLES TCL ANALYTICAL SERIES VOC	SVOC	ELEMENTS	PESTICIDES/PCBs
Building 43						
Wastewater	1	Water	1	1	--	--
Composite Soil Samples	2	Solids	2	2	--	--
Building 70						
Floor Core	3	Solids	--	3	3	3
Building 122						
Floor Wipe	2	Solids	--	2	--	2
Buildings 137, 139						
Floor Wipe	2	Solids	--	2	2	--
Concrete Chips	2	Solids	--	--	2	--
Building 142						
Floor Wipe	2	Solids	--	--	--	2
Building 361						
Floor Wipes	3	Solids	3	3	3	--
Total Wastewater	1		1	1	--	--
Total Composite Soil	2		2	2	--	--
Total Floor Cores	3		--	3	3	3
Total Floor Wipes	9		3	7	5	4
Total Concrete Chips	3		--	--	3	--

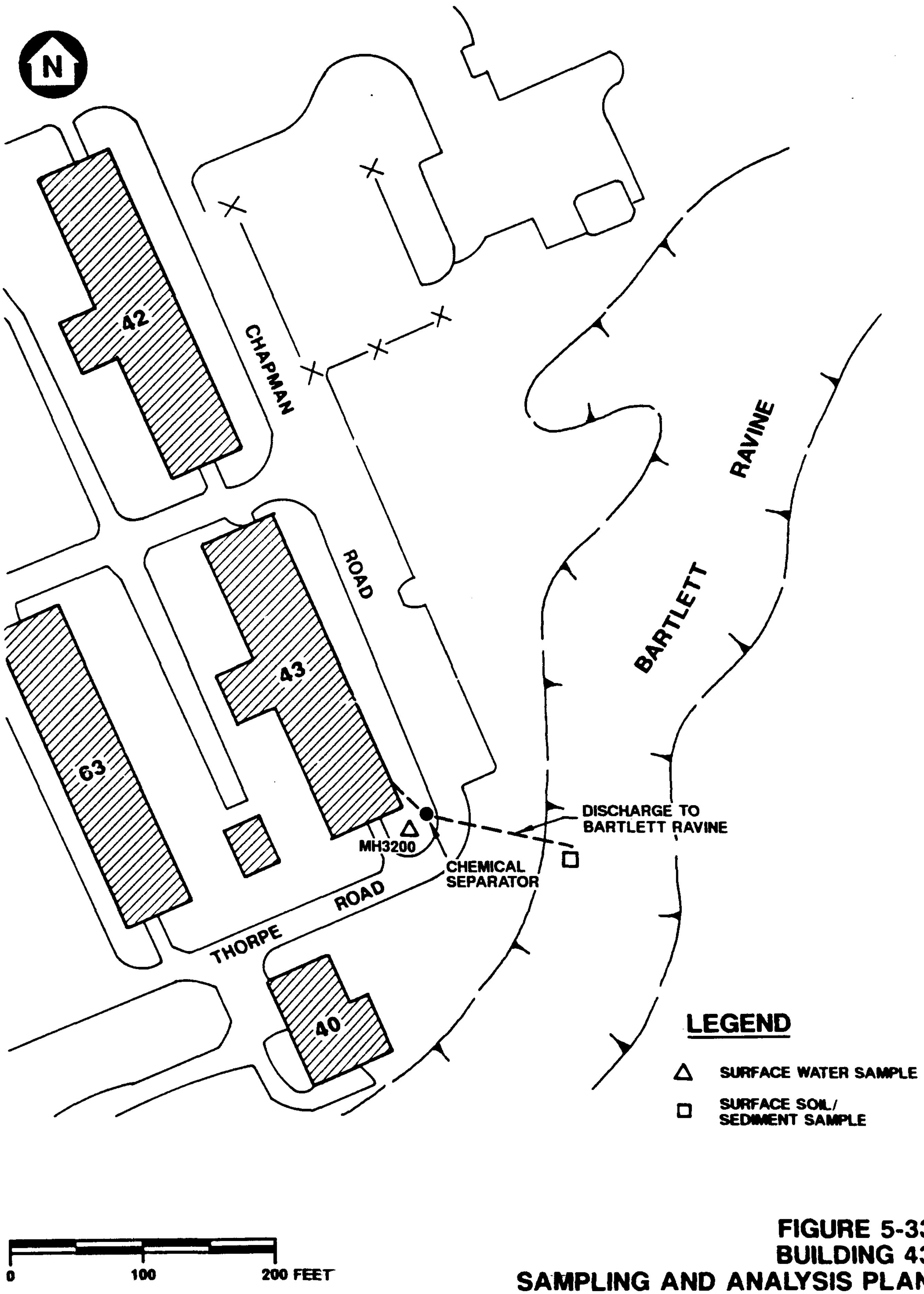

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FIGURE 5-33
BUILDING 43
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

This area is quite steep, therefore it is recommended that the surface soil samples be collected by hand methods if at all possible. The soil samples will be analyzed for TCL VOCs, SVOCs, and elements.

5.6.2 Building 70

5.6.2.1 Site Description. Building 70 is a single story, wooden frame, World War II vintage building used by the Directorate of Engineering and Housing as a warehouse. Of particular concern at this building is the wooden plank floor, which is darkly stained and discolored. Because the nature of the staining is unknown, it is recommended that samples of the floor be analyzed for SVOCs, pesticides/PCBs, and elements. See Figure 5-23 for the location of Building 70.

5.6.2.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- o characterize the staining by collecting samples of the stained wooden floor

5.6.2.3 Exploration and Sampling Program.

Core Sampling. Three samples of the wooden floor will be collected from areas where staining is observed. The samples will be collected using a hand powered corer. Because the nature of the staining is unknown and warehouse activities could have involved any number of chemicals, The wood floor samples will be analyzed for TCL SVOCs, pesticides/PCBs, and elements.

5.6.3 Building 122

5.6.3.1 Site Description. Building 122 is a modern concrete slab, steel frame building used for hazardous waste storage. There was no visual evidence of spills during an October 1989 site visit. The location of Building 122 is shown on Figure 5-23.

5.6.3.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- o characterize any hazardous substances on the floor of Building 122 to determine whether hazardous substances were spilled or leaked onto the floor

5.6.3.3 Exploration and Sampling Program.

Floor Wipes. Two floor wipes will be collected from the floor of Building 122 to determine whether hazardous substances have been spilled or leaked onto the floor. Sampling procedures using floor wipes are described in the QAPP. The floor wipe samples will be analyzed for TCL SVOCs, pesticides/PCBs, and herbicides.

Storm Sewer Sampling. Two sediment samples will be collected from the adjacent storm sewer (at the southern corner of Building 149). These sediment samples

will be analyzed for TCL SVOC, pesticides/PCBs, and elements. Sampling procedures for storm sewers are described in the QAPP.

5.6.4 Buildings 137 and 139

5.6.4.1 Site Description. Building 137, the Tactical/Combat Armament Shop, and adjacent Building 139, the Heavy Equipment Maintenance Shop, serve as centers for maintenance of vehicles and equipment ranging in size from lawnmowers to large trucks. These are masonry buildings with concrete floors. Floor drains are cast into the concrete floors. Of particular concern at these buildings are areas devoted to battery maintenance and equipment cleaning. The concrete floor of the battery room in Building 137 has experienced significant corrosion from battery acid, and may be contaminated with toxic metals.

Building 137 also contains a work bay devoted to parts cleanup and equipment washing. Parts are cleaned in recirculating parts washers; however, vehicles and large pieces of equipment are cleaned on the bay floor. Floor drains collect wash water and direct it to an oil-water separator before discharge to the sanitary sewer. The bay floor is extremely stained. The location of Buildings 137 and 139 is shown in Figure 5-24.

5.6.4.2 Technical Objectives. The following technical objective is based on data needs identified in the Technical Plan:

- characterize any hazardous substances on the floor of Building 137 to determine whether hazardous substances were spilled or leaked onto the floor

5.6.4.3 Exploration and Sampling Program

Floor Wipes. Two floor wipes will be collected from the wash bay floor where cleaning activities occurred. Sampling procedures using floor wipes are described in the QAPP. The floor wipe samples will be analyzed for TCL SVOCs to determine whether hazardous chemicals have contaminated the concrete floor.

Concrete Chips. Three samples of concrete chips will be collected from locations on the floor of the battery maintenance room in Building 137. Chips should be obtained from two locations where corrosion of the concrete is evident, and from one location where no corrosion is evident. The QAPP contains sampling procedures for collecting concrete chip samples. The chips should be analyzed for TCL elements.

5.6.5 Building 142

5.6.5.1 Site Description. This is a multistory masonry building used for administrative purposes. The building basement has a concrete floor. Two large transformers located in Building 142 were discovered to be leaking in 1981. A contractor was hired at that time to replace the PCB cooling oil and clean up the spill. The transformers have since been removed and replaced with transformers installed outside. A electric power distribution panel has been installed at the approximate location of the leaking transformers. Figure 5-34

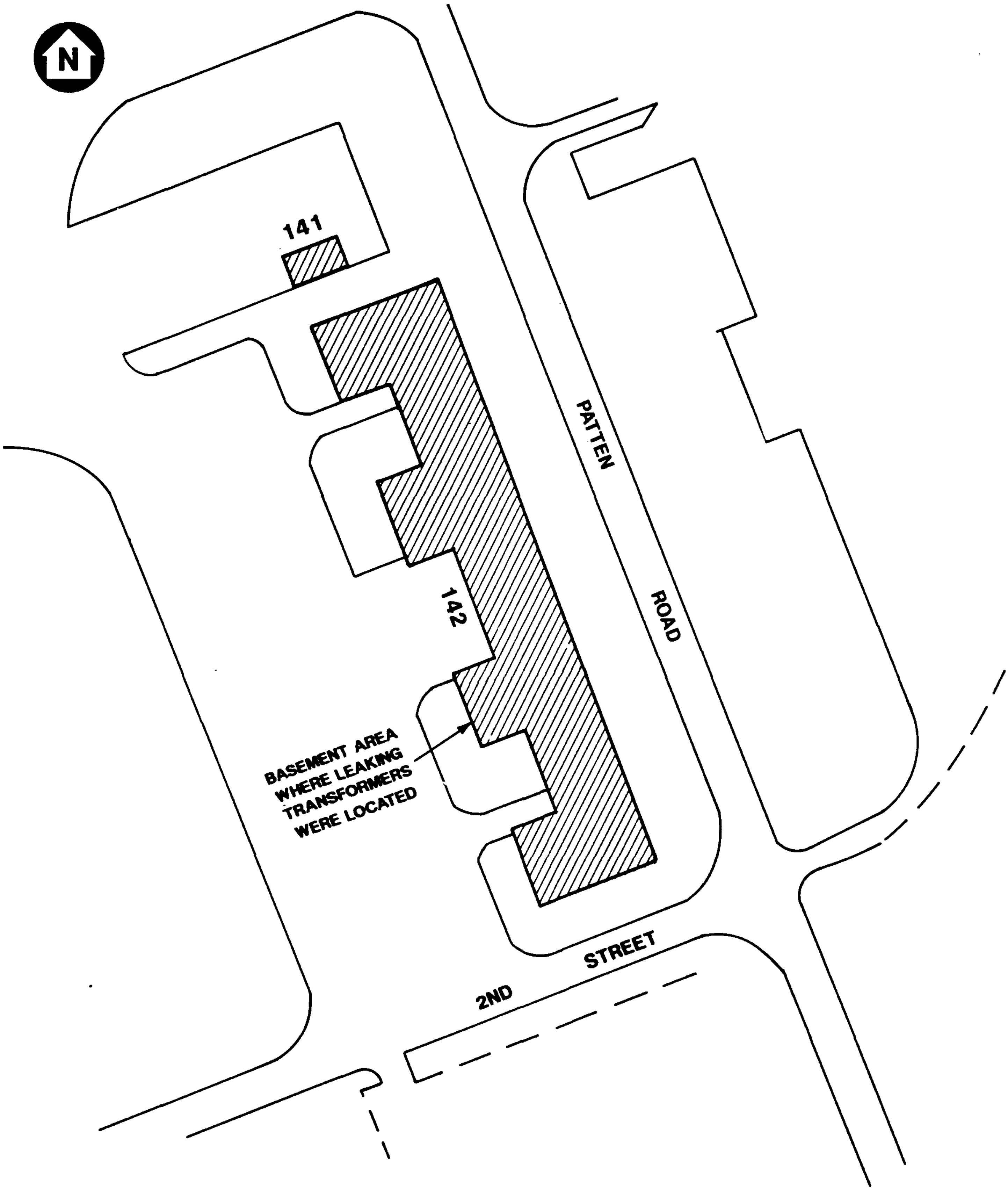

FIGURE 5-34
BUILDING 142
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

shows the location of Building 142, and approximate location of the leaking transformers.

5.6.5.2 Technical Objectives. The following technical objective is based on data needs identified in the Technical Plan:

- o determine whether two leaking transformers contaminated the concrete basement floor in Building 142

5.6.5.3 Exploration and Sampling Program.

Floor Wipes. A total of two floor wipes will be collected from the concrete floor beneath the former location of the leaking transformers. No staining was observed during the October 1989 visit. Sampling procedures using floor wipes are described in the QAPP. The floor wipe samples will be analyzed for TCL pesticides/PCBs to determine whether the floor is contaminated with PCBs.

5.6.6 Building 361

5.6.6.1 Site Description. Building 361 is a masonry building that has been used for photo-processing since the 1950s. On the first floor there are three film processors that discharge treated, spent sodium thiosulfate solution (i.e., photographic fixer, hypo) and rinse water to three floor drains connected to the sanitary sewer. A manhole just outside the building wall receives the discharge and directs it to the sanitary sewer. The location of Building 361 is shown in Figure 5-35.

The laboratory has had a silver-recovery system for spent hypo since 1978. Treated hypo is sent to the Defense Property Disposal Office (DPDO) at the Great Lakes Naval Training Center for disposal.

Prior to disposal at the DPDO, spent hypo was discharged to the sanitary sewer. Spent developer is discharged to the sanitary sewer. Floor tiles adjacent to the floor drains in this building are deteriorating from exposure to photo-processing chemicals.

5.6.6.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- o determine whether floor tiles from the Photo Lab have been contaminated with photo-processing chemicals

- o characterize sediment quality within the sewer manhole immediately behind the building

5.6.6.3 Exploration and Sampling Program.

Floor Tile Wipe Samples. Three floor wipe samples will be collected adjacent to the floor drains in the building. The procedures for collecting floor wipes are described in the QAPP. The floor wipes will be analyzed for TCL VOCs, SVOCs, and elements to determine whether the floor is contaminated with photo-processing chemicals.

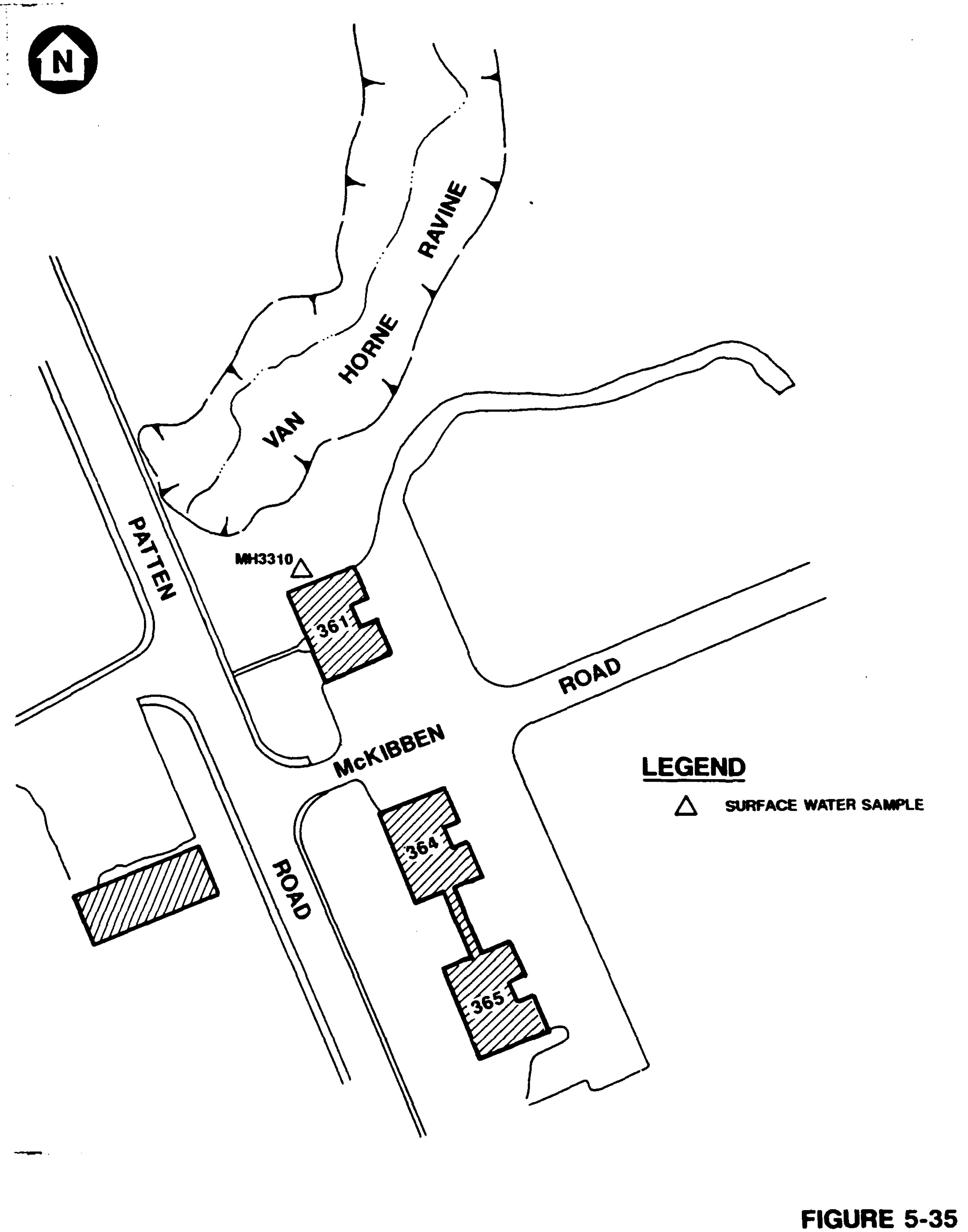

FIGURE 5-35
BUILDING 361
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

Sewer Sampling. One sediment sample will be collected from within the sewer (Manhole 3310) located immediately behind Building 361 (northern side). This sediment sample will be analyzed for TCL SVOCs and elements.

5.7 NIKE MISSILE INSTALLATION

5.7.1 Missile Silos

5.7.1.1 Site Description. Three abandoned NIKE-missile batteries are located within two fenced areas near the Reserve Center at the northwestern corner of Fort Sheridan. Each battery consisted of an estimated five underground silos. When operational, each missile silo was covered with large steel plate doors. Personnel access was by a 4-by-4-foot steel door. The chamber doors may have been welded shut at the time of decommissioning. The chambers are thought to be full of water. The fenced area around the missile chambers is used for storage.

5.7.1.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- characterize the water that has accumulated within each of the missile silos

- observe the interior of each silo to determine if hydraulic, electrical, or other equipment that could potentially contaminate groundwater has been abandoned in place

5.7.1.3 Exploration and Sampling Program. Figure 5-36 shows the location of the abandoned missile batteries at Fort Sheridan. Table 5-13 summarizes the exploration program and Table 5-14 summarizes the sampling and analytical program at the missile installation.

Groundwater sampling. Two samples of accumulated groundwater will be collected from each missile battery. One of the samples from each silo will be from near the liquid surface and include any surface scum or film. The second sample will be from the base of the water column. The samples will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, and elements.

Interior Observation. Visual observation of the interior of each silo can be accomplished either by a diver, if the results of analysis indicate that the accumulated water will not pose a dermal exposure hazard and if a review of available information and preliminary inspection indicates that use of a diver is feasible. If use of a diver is not feasible, each silo will be dewatered before inspection. Pumped water, treated if necessary to reduce contamination, will be disposed of by discharge to the sanitary sewer, discharge to the storm sewer, or by other appropriate means and in accordance with all USEPA, state, or local requirements. The observers will survey the interior for abandoned equipment or other contents that may be potential sources of hazardous materials. Any potential sources will be examined to identify, if possible, the type of hazardous material present and for evidence of leaks. Entry into the silos will require that safety precautions appropriate for confined space entry be taken.

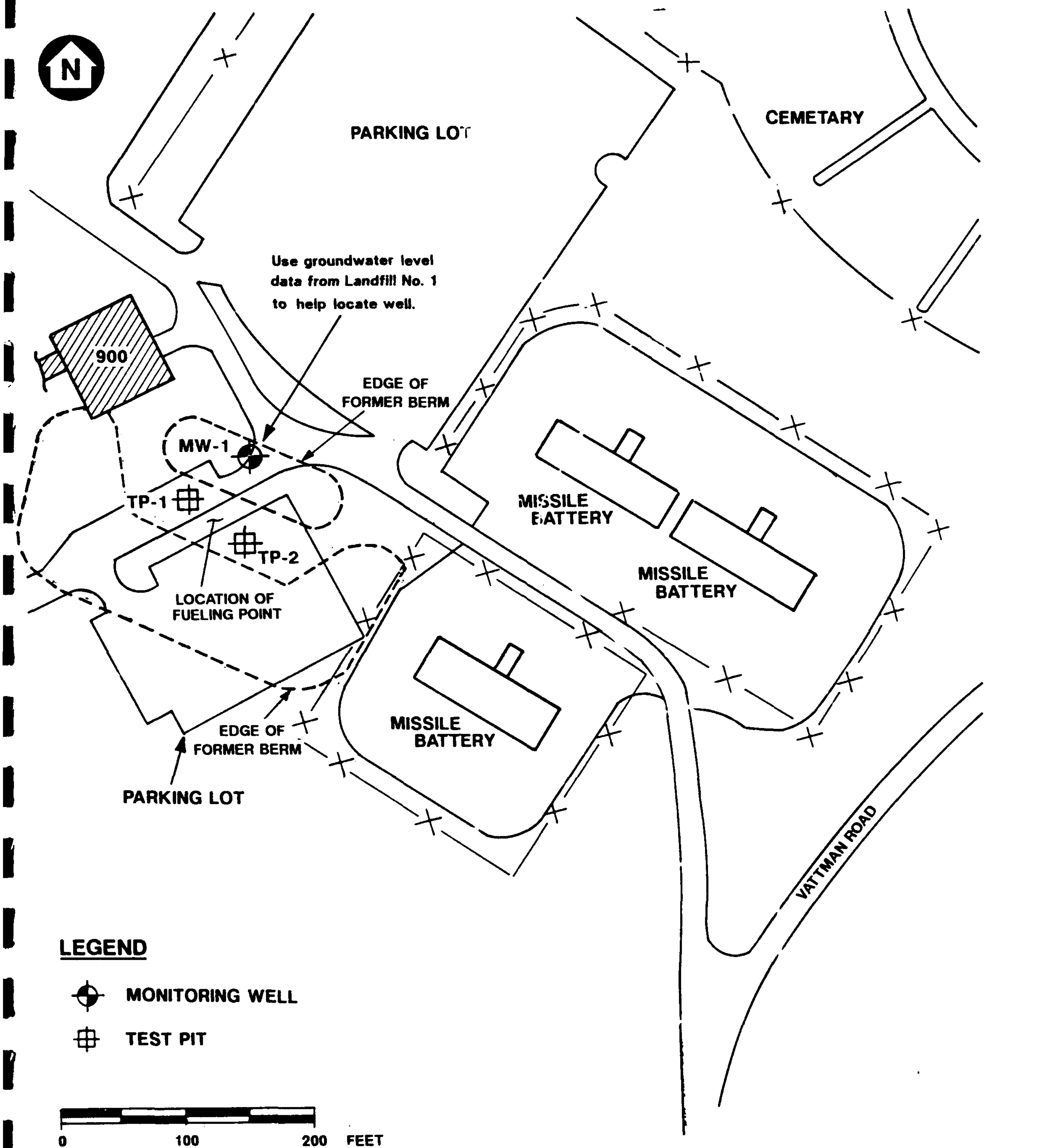

FIGURE 5-36
NIKE MISSILE SITE
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

TABLE 5-13
BACKHOE, DRILLING AND MONITORING WELL SUMMARY
FOR NIKE MISSILE INSTALLATION

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

EXPLORATION/SITE	NO. OF EXPLORATIONS	TOTAL DEPTH OF EXPLORATIONS (L.F.)	DEPTH TO GWT (FT.)	NO. OF SPLIT-SPOON SAMPLES		PVC SCREEN (L.F.)	PVC RISER (L.F.)	BENT. PELLET SEAL (L.F.)	CLAY GROUT (L.F.)	PROTECTIVE WELL CASING	55-GALLON DRUMS	WELL DEVEL. (HRS)
				CONT. (NO.)	5-FOOT (NO.)							
Test Pits												
Missile Silos	--	--	--	--	--	--	--	--	--	--	--	--
Missile Fueling Point	2	30	15	--	--	--	--	--	--	--	--	--
Soil Borings												
Missile Silos	--	--	--	--	--	--	--	--	--	--	--	--
Missile Fueling Point	--	--	--	--	--	--	--	--	--	--	--	--
Soil Borings with Monitoring Wells												
Missile Silos	--	--	--	--	--	--	--	--	--	--	--	--
Missile Fueling Point	1	25	15	12	--	10	15	5	3	1	2	12

TABLE 5-14
SUMMARY OF ANALYTICAL SAMPLING PROGRAM FOR
NIKE MISSILE INSTALLATION

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

			NUMBER OF SAMPLES				
			TCL ANALYTICAL SERIES				
SITE AND EXPLORATION TYPE	NUMBER OF EXPLORATIONS	MEDIA	VOC	SVOC	ELEMENTS	PESTICIDES/PCBs	NITROAROMATICS
Missile Silos							
Silo Interiors	15	Water	30	30	30	30	--
Missile Fueling Plant							
Test Pits	2	Soil	4	4	4	--	4
Borings	1	Soil	3	3	3	--	3
Monitoring Wells	1	Water	1	1	1	--	1
Total Soil Samples			7	7	7	--	7
Total Water Samples			31	31	31	30	1

5.7.2 Missile Fueling Point

5.7.2.1 Site Description. Missile fueling was performed at a bermed area northwest of the missile batteries. As shown in Figure 5-36 this area is now a paved parking lot.

5.7.2.2 Technical Objectives. The following technical objectives are based on data needs identified in the Technical Plan:

- o characterize surface and subsurface soils at the site of the former missile fueling area

- o investigate shallow groundwater quality downgradient of the fueling area

5.7.2.3 Exploration and Sampling Program.

Test Pit Program. A minimum of two test pits will be dug at the former fueling point to investigate surface and subsurface soils. If necessary, a jackhammer will be used to remove the pavement prior to test pitting. The test pits will be terminated at the water table or at a maximum depth of 15 feet. The stratigraphy of the test pits will be logged by the field geologist and two soil samples per test pit will be submitted for laboratory analysis. The soil samples should be collected from soils that are either visibly stained or that show elevated PID readings. The samples will be analyzed for TCL VOCs, SVOCs, elements, and nitroaromatic compounds.

Soil Boring Program. One soil boring will be installed immediately downgradient of the former fueling point. The proposed location is shown in Figure 5-36. The actual location of the boring may be adjusted in the field based on the findings of the test pit investigation and on groundwater gradient data from wells installed at Landfill No. 1. The boring will be completed as a shallow boring, estimated to be 25 feet in depth, approximately 10 feet below the water table. The boring will be sampled continuously, using split-spoon samplers. Soil samples will be screened in the field using a portable PID. If elevated PID readings are detected in the soils from the bottom of the borehole, the borehole will be advanced further, until a minimum of two split-spoon soil samples shows no elevated PID levels. If the resultant is more than 3 feet below the anticipated bottom of the screen, the bottom of the borehole will be grouted with a high solids bentonite grout up to 3 feet from the expected bottom of the screen. (See the QAPP, Data Item A0006 for a description of grouting procedures and specifications).

Based on the field screening results, three soil samples from the boring will be submitted for laboratory analysis. The soil samples from the boring will be analyzed for TCL VOCs, SVOCs, elements, and nitroaromatic compounds.

Monitoring Well Installation. A 4-inch I.D. monitoring well will be installed in the borehole upon completion. The monitoring well will be constructed of flush-joint, threaded Schedule 40 PVC pipe and screen. The screen will be positioned to extend from approximately two feet above the water table to 8 feet

below. The annulus around the wellscreen and at least 5 feet above the top of the screen, will be backfilled with clean silica sand. A minimum 5-foot-thick bentonite pellet seal will be placed above the sandpack. The completed well will be equipped with a 5-foot-long steel protective casing with lock which extends approximately 2.5 feet above ground surface. (See the QAPP for detailed drawings and descriptions of well installations.)

Upon completion, the monitoring well will be developed to remove sediment and establish a hydraulic connection to the aquifer. If conditions permit, the well will be developed using block and surge techniques. (See the QAPP for a detailed description of well development.) If groundwater recharge into the well is very slow, the well will be developed by purging five well volumes or an alternate method as approved by USATHAMA.

In-situ permeability tests will be conducted in the well to measure site-specific permeabilities of the silty clay till and, if present, the silt or sand lenses. In-situ permeability testing will be conducted using an electronic data logger and pressure transducer according to specifications described in the QAPP.

A groundwater sample will be collected from the well at this site. Sampling will not occur sooner than 14 days following well development or permeability testing. The groundwater sample will be analyzed for TCL VOCs, SVOCs, elements, and nitroaromatic compounds.

5.8 STORM DRAINAGE AND RAVINE SYSTEM

5.8.1 Site Description

A series of six major ravines: Janes, Hutchinson, Bartlett, Van Horne, Wells, and Schenck traverse Fort Sheridan. Each runs, or ran before filling, in a general northeasterly direction from the western boundary of Fort Sheridan to Lake Michigan, a distance which varies from approximately 0.5 to 0.7 mile. The ravines are steep-sided and typically support mature hardwood trees. The ravines are about 30 to 50 feet deep at their eastern end, where their bottoms are a few feet above lake level. The ravines become increasingly shallow as the distance from Lake Michigan increases. At their mouths, the ravines are typically 200 to 400 feet wide.

These ravines were filled extensively in the past, both to dispose of waste materials and to create additional usable land. Wells Ravine has been filled completely. In addition, the ravines are used to collect stormwater runoff and direct it to Lake Michigan. In some cases, storm sewers were laid along the ravine bottoms to allow passage of stormwater under landfills and roads. In other cases, the storm sewers along the ravine bottoms are discontinuous. In either case, surface releases from past and current operations and leachate from documented and undocumented landfills would be directed to the storm sewer system and the ravines. Storm water may contain VOCs, SVOCs, pesticides, herbicides, and metals associated with multiple sources.

The storm sewer in Wells Ravine transports stormwater runoff from the Town of Highwood, as well as from Fort Sheridan. Review of the storm drainage system map indicates that Janes, Hutchinson, and Bartlett ravines probably also receive runoff from off-post areas.

There is a road along the bottom of the southern branch of Bartlett Ravine. Access to the unfilled portion of the northern branch of Bartlett Ravine, and to Janes, Hutchinson, Van Horne, and Schenck ravines, is by foot.

5.8.2 Technical Objectives

The following technical objectives are based on data needs identified in the Technical Plan:

- characterize stormwater/runoff water quality in the Fort Sheridan storm sewer system and in the ravines

- characterize the level of contamination in sediments in the storm sewer system and in ravines

5.8.3 Exploration and Sampling Program

A total of 31 water and 31 sediment samples will be collected from manholes and outfalls within the Fort Sheridan storm sewer system to determine whether sites of known or probable releases are contaminating storm water and if the storm sewer presents a migration route for contaminated surface water runoff and associated sediments. The storm sewer sampling locations are shown in Figure 5-37. Table 5-15 summarizes the storm sewer sampling locations and rationale.

The storm sewer sampling should take place during a relatively high groundwater period, but not immediately following a heavy rain event. This way, the water and sediments will be more representative of leachate and site-related runoff rather than overland flow from precipitation. An ideal sampling time might be in late spring or early summer. Storm sewers located downgradient of sites where invasive investigations are taking place (water or mud rotary drilling primarily) should not be sampled during or immediately after the drilling program, so as to avoid sampling heavy runoff from the drilling activities.

5.9 GROUNDWATER LEVEL MEASUREMENT PROGRAM

5.9.1 Site Description

Thirty-six new 4-inch diameter shallow monitoring wells and four deep monitoring wells will be installed at Fort Sheridan as part of this RI. In addition, there are four existing shallow wells and an undetermined number (at least five) of 1½-inch PVC piezometers. These wells and piezometers are located across the entire post and can provide a comprehensive network of groundwater level monitoring points.

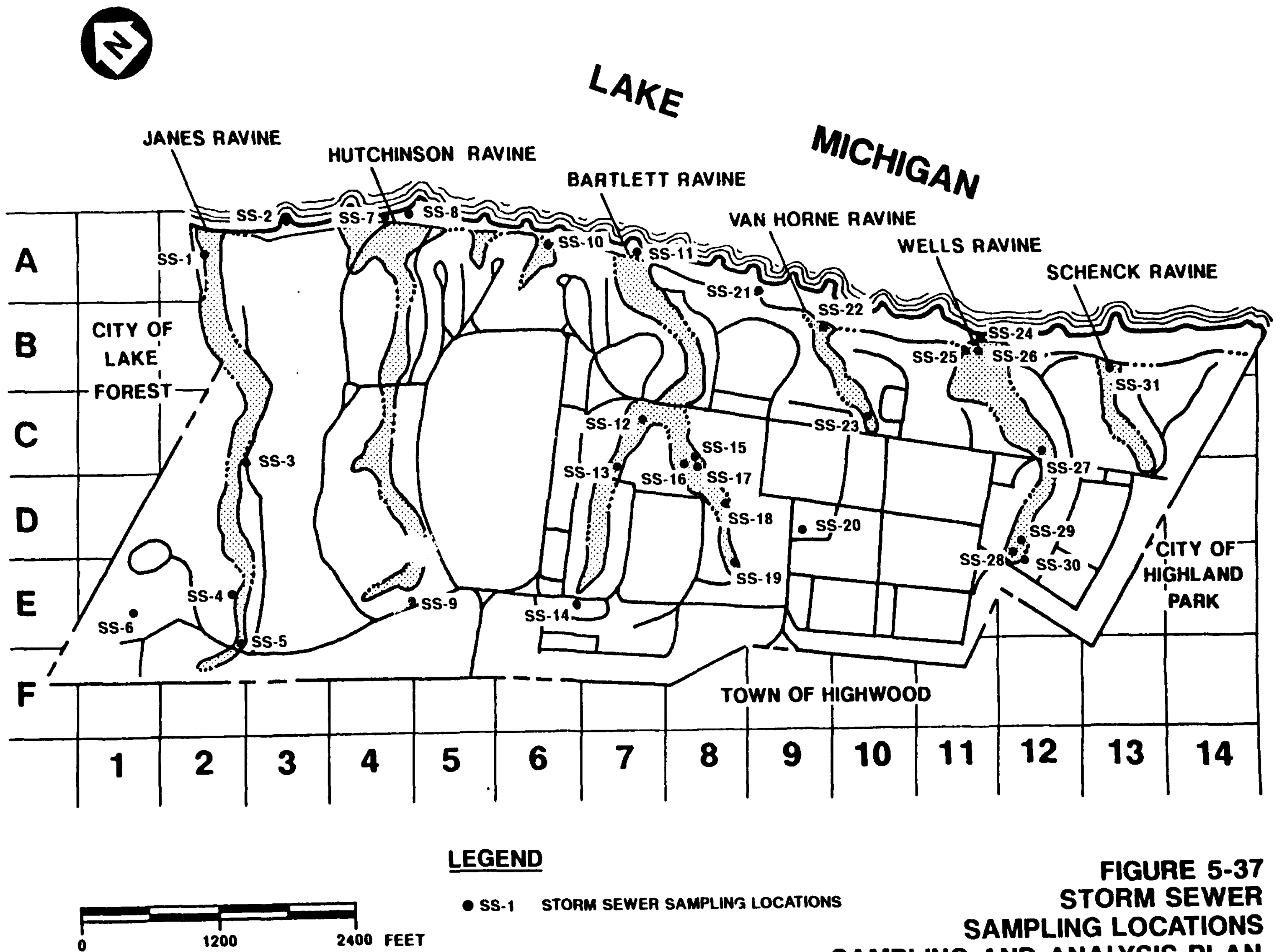

FIGURE 5-37
STORM SEWER
SAMPLING LOCATIONS
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

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TABLE 5-15
STORM SEWER SAMPLING LOCATIONS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

SAMPLE NUMBER	SAMPLING STRUCTURE	LOCATION	PURPOSE
SS-5	C-0130	Janes Ravine	Upstream Sample Location
SS-4	MH-0031	Janes Ravine	Downstream of Reserve Center
SS-3	C-0242	Janes Ravine	Downstream of Pesticide Storage - Building 172
SS-1	Open Drainage	Janes Ravine	Downstream Sample Location, South Branch of Janes Ravine
SS-6	CB-0038	Landfill No. 1	Downstream of former Landfill No. 1
SS-9	C-0732	Hutchinson Ravine	Upstream Sample Location; downstream from Highland Park
SS-8	MH-0691	Hutchinson Ravine	Downstream of Landfill No. 2
SS-12	C-2370	Bartlett Ravine	Downstream of Landfill No. 3
SS-13	MH-2560[1]	Bartlett Ravine	Downstream of Landfill No. 4
SS-14	MH-2760	Bartlett Ravine	Upstream of Landfills Nos. 3 and 4
SS-15	MH-3850	Bartlett Ravine	15-inch RCP from MH-4510; downstream of Landfill No. 5
SS-16	MH-3850	Bartlett Ravine	24-inch RCP from MH-3870; downstream of main branch of Bartlett Ravine
SS-17	MH-3850	Bartlett Ravine	24-inch RCP from MH-4590; downstream of Building 377
SS-20	MH-4491[2]	Bartlett Ravine	Upstream of Landfill No. 5
SS-19	MH-4120	Bartlett Ravine	Downstream of Buildings 137 and 137X
SS-18	MH-3940	Bartlett Ravine	Downstream of Buildings 139, 137, and 40

TABLE 5-15
(continued)
STORM SEWER SAMPLING LOCATIONS

SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

SAMPLE NUMBER	SAMPLING STRUCTURE	LOCATION	PURPOSE
SS-11	MH-3300	Bartlett Ravine	Downstream Sampling Location
SS-23	C-5030	Van Horne Ravine	Downstream of Building 361
SS-22	C-5360	Van Horne Ravine	Downstream Sample Location
SS-28	MH-6330	Wells Ravine	42-inch RCP from MH-6331; downstream of off-post areas
SS-29	MH-6330	Wells Ravine	30-inch RCP from MH-5770; upstream of Landfill No. 6
SS-30	MH-6330	Wells Ravine	24-inch RCP from MH-5720; upstream of Landfill No. 6
SS-27	MH-6130	Wells Ravine	Downstream of Landfill No. 6
SS-25	Area Inlet 10	Near Toe of Slope at Wells Ravine	Sample Storm Sewer Drainage, 36-inch RCP
SS-26	Area Inlet 10	Near Toe of Slope at Wells Ravine	Sample Landfill Cap Drainage, 18-inch RCP
SS-24	Stilling Basin	Near Toe of Slope at Wells Ravine	Storm sewer drainage downstream of Area-Inlet 10
SS-2	C-0300	Near Fish Pond	
SS-7	C-0690	Hutchinson Ravine	Downstream of Landfill No. 2
SS-10	Open Drainage	East of Scott Road	Downstream of golf course and former hospital
SS-21	MH-4810	East of Scott Road	Downstream of Boles Loop
SS-31	Open Drainage	Schenck Ravine	Downstream Sample Location

NOTES:

C - Culvert CB - Catch Basin MH - Manhole
No need to sample leachate pump station because it is not operational.

[1] MH-2710 should be sampled in lieu of MH-2560 if the former is located.
[2] MH-4550, MH-4560, MH-4570, or MH-4580 should be sampled in lieu of MH-4550 if any of the former are located.

5.9.2 Technical Objectives

Obtain a post-wide set of groundwater levels from all newly installed shallow and deep monitoring wells and existing piezometers to:

- o aid in the interpretation of groundwater flow directions at each site
- o calculate horizontal and vertical groundwater flow rates, and
- o estimate contaminant transport routes and rates

5.9.3 Exploration and Sampling Program

Groundwater levels will be measured in a total of 36 newly installed shallow wells, 4 existing shallow wells, 4 deeper wells, and any previously existing piezometers. Approximately five piezometers were observed to have water in them during an October 1989 site visit. Their locations are shown on Figure 5-38. In addition, the water level in the recreational pond will be surveyed to determine whether continuous filling of the pond is causing mounding. The water levels will be collected using electronic water level meters and steel tape, and will be conducted over a period of one day if possible. Water levels will be taken no sooner than two weeks after well development and stabilization (based on measurement of pH and specific conductance). This data will be used to construct a detailed groundwater surface contour map for Fort Sheridan. In addition, the horizontal flow rates and vertical seepage gradients will be calculated from the data.

5.10 POLE-MOUNTED TRANSFORMERS

5.10.1 Site Description

There are numerous pole-mounted transformers at Fort Sheridan which may contain PCBs.

5.10.2 Technical Objectives

The following technical objectives are based on the data needs identified in the Technical Plan:

- o inventory all pole-mounted transformers

- o determine the type of dielectric fluid in the transformer and if it contains PCBs

- o determine if any pole-mounted transformers contain PCBs and at what level

5.10.3 Exploration and Sampling Program

A sample of transformer fluid will be collected from all suspect transformers and analyzed for PCBs. Samples will be collected directly from transformer bottom taps or withdrawn from other access points using disposable glass pipettes.

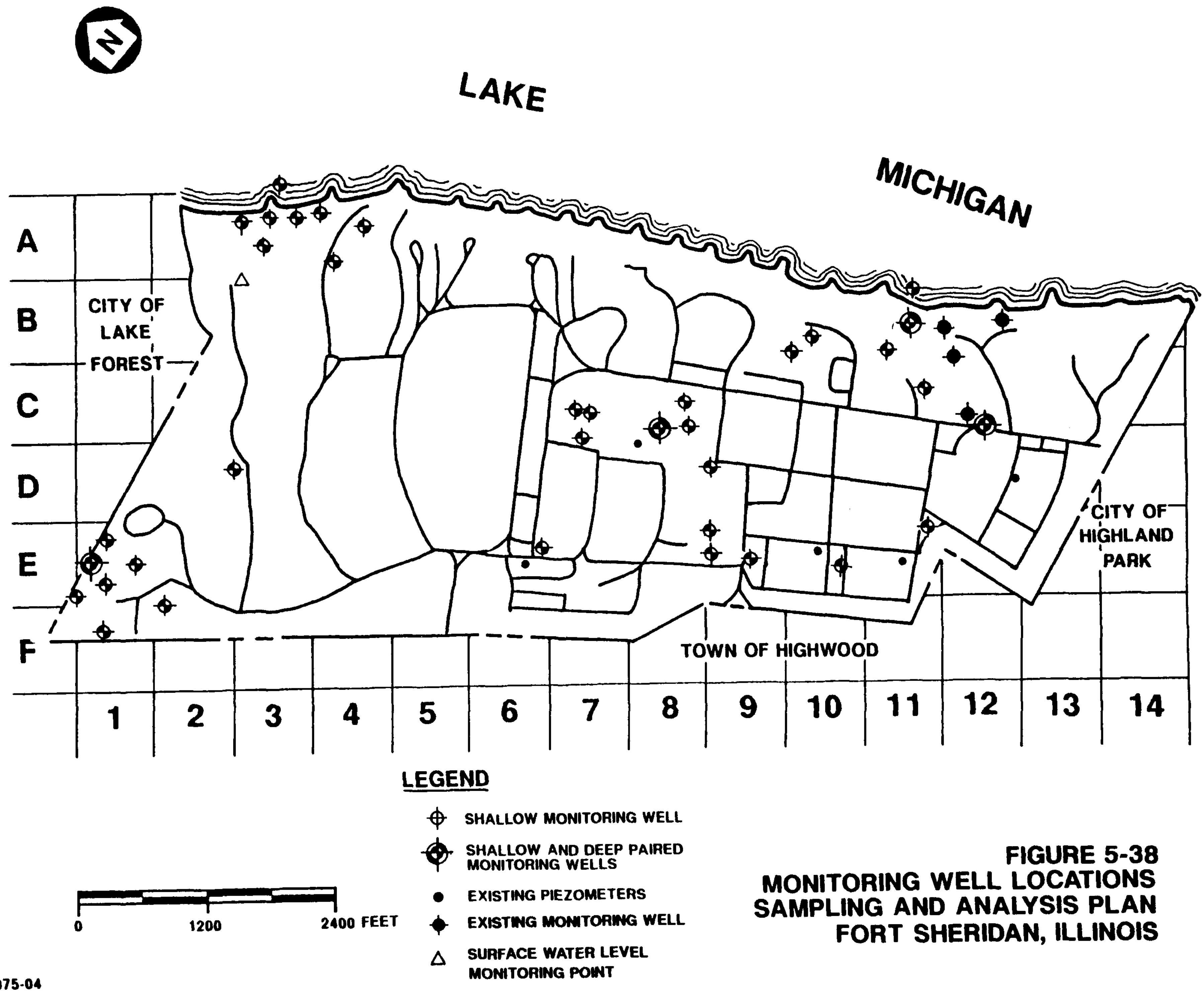

FIGURE 5-38
MONITORING WELL LOCATIONS
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

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5.11 ASBESTOS CONTAINING MATERIALS IN BUILDINGS

5.11.1 Site Description

There are an estimated 150 buildings, many of them multi-unit, that are dedicated to personnel housing at Fort Sheridan. The buildings are distributed throughout most of the area east of Patten Road as well as along Leonard Wood Avenue and the western end of Nicholson Road.

5.11.2 Technical Objectives

The following technical objectives are based on data needs identified in the Technical Plan:

- o identify the presence and location of asbestos-containing materials in personnel housing
- o evaluate the condition of asbestos-containing materials

5.11.3 Exploration and Sampling Program

Subcontract with a qualified asbestos contractor to visually survey housing units for the presence of asbestos-containing materials.

5.12 SMALL ARMS AND COASTAL ARTILLERY IMPACT AREAS

5.12.1 Site Description

The location of three artillery impact areas is shown in Figure 5-39. All of them are in Lake Michigan.

5.12.2 Technical Objectives

The following technical objectives are based on data needs identified in the Technical Plan:

- o perform a survey of the impact areas to locate any UXOs
- o mark location of unexploded UXOs so that the 51st Explosive Ordnance Detactment at Fort Sheridan can evaluate/develop render safe plans.

5.12.3 Exploration and Sampling Program

USATHAMA is negotiating with the U.S. Navy to investigate the presence of UXOs in the Fort Sheridan impact areas of Lake Michigan. If these negotiations are not fruitful, the COR will direct the RI contractor to subcontract the UXO investigation to a qualified UXO contractor. A Standard Operating Procedure (SOP) for this work will be developed either by the Navy or by the UXO subcontractor (see Appendix A).

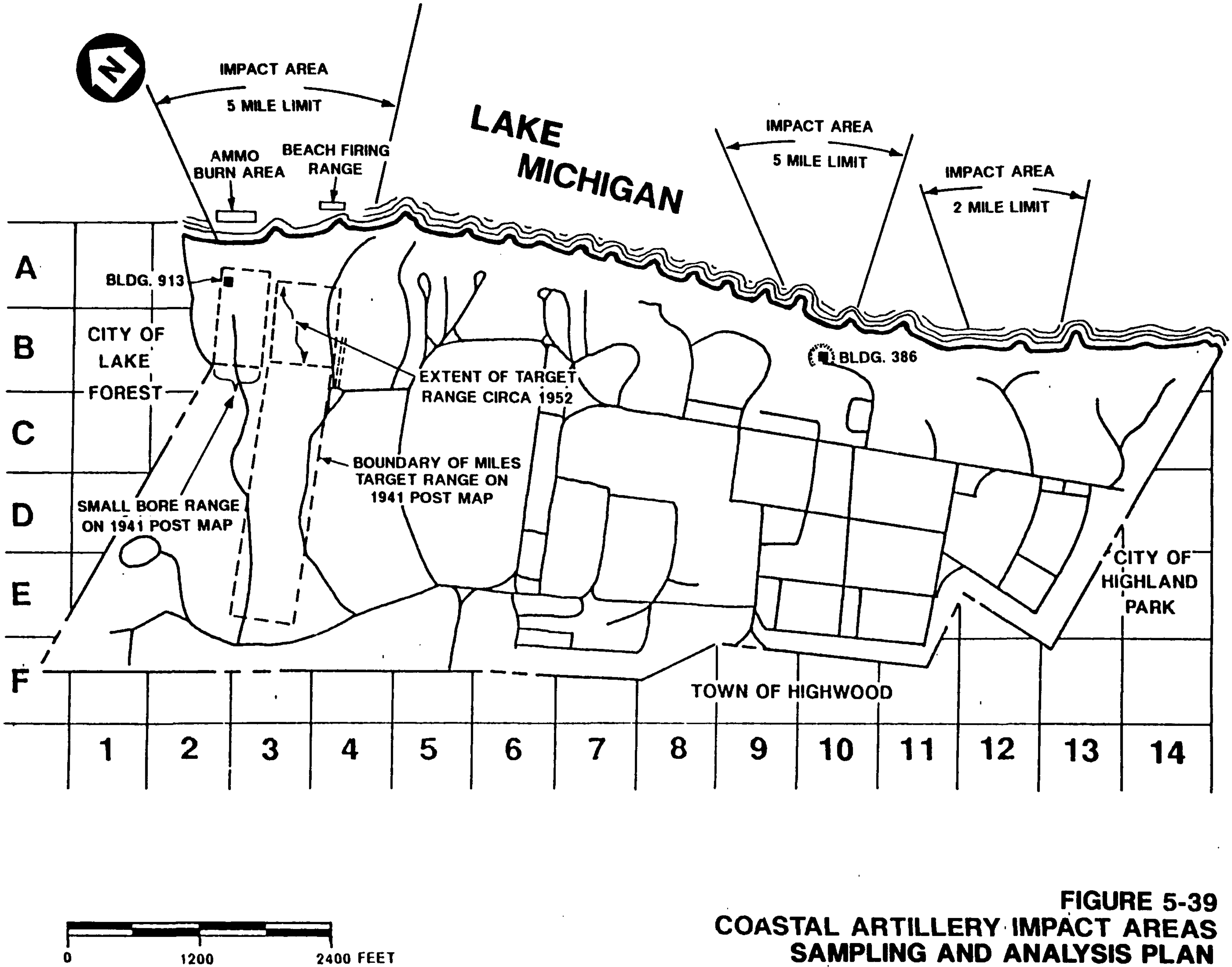

FIGURE 5-39
COASTAL ARTILLERY IMPACT AREAS
SAMPLING AND ANALYSIS PLAN
FORT SHERIDAN, ILLINOIS

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APPENDIX A

GENERAL CONTRACT STATEMENT FOR U.S. ARMY
TOXIC AND HAZARDOUS MATERIALS AGENCY,
UNEXPLODED ORDNANCE CONTRACTOR SUPPORT

General Contract Statement
for
U.S. Army Toxic and Hazardous Materials Agency
Unexploded Ordnance
Contractor Support

1. Special Considerations.

a. This statement is intended to provide general guidance. It is not intended to be all inclusive and users are reminded that required contract content must be based on a thorough project and site specific analysis; however, deviations from this statement shall be reviewed and approved by the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) Health and Safety Branch.

b. Found items of ordnance that are known or thought to contain chemical agents will not be recovered by Unexploded Ordnance (UXO) contractor personnel. UXO contractor personnel will not perform any explosive ordnance disposal (EOD) render safe or disposal procedures on items of ordnance known or thought to contain chemical agents. The USATHAMA Health and Safety Branch will be contacted immediately at (301) 671-4811 or AUTOVON 584-4811, if items of ordnance thought or known to contain chemical agent are located. The USATHAMA Health and Safety Branch will make the necessary coordination with the U.S. Army Technical Escort Unit and their higher headquarters. Chemical agents, as defined in AR 50-6, are any chemical compounds used in military operations to kill, seriously injure, or incapacitate persons through their chemical properties. Excluded from the definition of chemical agents are riot control agents, chemical defoliants and herbicides, smoke, flame and incendiaries, industrial chemicals, and conventional high or low explosives. The UXO contractor will provide interim security for any known or suspect chemical agent munitions (category II chemical surety materiel) encountered. This security should be maintained until such time that Government control of the items is assumed.

c. This contract statement requires the UXO contractor to coordinate and make arrangements for render safe and disposal operations with military EOD and/or installation personnel before the start of any field work. During the performance of these operations, the military EOD and/or installation personnel are in charge. Military EOD will not take taskings from the UXO contractor.

2. General. (Statement of Services)

a. The UXO contractor shall provide the UXO qualified personnel and equipment necessary to locate, identify, recover/remove, and consolidate all ordnance or energetic

C.1

items from work areas, except as identified in paragraph 1b. above. These efforts will be conducted in a safe and environmentally acceptable manner. If the ordnance items are thought to be expended, the UXO team will make that assessment and remove and dispose of these items as nonhazardous waste. All unexploded ordnance and/or energetic materials that are safe to move will be collected and staged at a properly sited holding area onsite pending disposal.

b. The UXO contractor shall provide the UXO qualified personnel and equipment necessary to perform surface clearance/sweep work to locate surface ordnance or explosives.

c. The UXO contractor shall provide the UXO qualified personnel and equipment necessary to perform geophysical remote sensing techniques to detect subsurface ordnance items. Geophysical techniques, which may include seismic methods, metal detection, magnetometry, ground penetrating radar, resistivity, geophysical diffraction tomography, and electromagnetic induction, shall be considered and recommended by the UXO contractor, where appropriate, to detect subsurface ordnance.

d. Detailed standing operating procedures (SOPs) for all UXO operations shall be prepared and submitted for USATHAMA approval as an addendum to the contract required Safety and Health Plan. The UXO contractor's operating procedures, methods and approach shall be addressed in all contract technical, management, work, field operating, and accident prevention plans. Additionally, if military EOD will be responsible for supporting portions of the operation, they must be involved in the formulation of procedures.

e. UXO operations will not be conducted during the hours from sunset to sunrise or during thunder/lightning (electric) storms or other severe weather conditions or if these conditions are imminent.

f. UXO operations, i.e. identification, shall be conducted by a minimum of two relatively equally UXO qualified and knowledgeable individuals.

g. The UXO qualified project officer shall have direct access to the contracting officer's representative (COR) or the contracting officer (KO). Areas of disagreement between a UXO subcontractor and the prime contractor shall be referred to the COR or KO for resolution.

h. The UXO contractor shall have the onsite, immediate capability and equipment to communicate with offsite emergency response organizations as required.

i. The UXO contractor will coordinate and establish written arrangements/agreements with the geographically responsible military EOD unit for the rendering safe of unexploded ordnance that may be required under this contract. Render safe arrangements/agreements will be coordinated and established with the geographically responsible military EOD unit prior to the start of any field work under this contract. Render safe procedures will be accomplished in accordance with the 60 series EOD publications by military EOD personnel. The UXO contractor may assist the military EOD personnel in the performance of render safe procedures as directed by the senior military EOD person onsite; however, the military EOD are in charge of this operation and will not take taskings from the UXO contractor. Render safe arrangements made under this contract will be approved by the USATHAMA Health and Safety Branch.

j. The UXO contractor will coordinate and establish written arrangements/agreements with the geographically responsible military EOD unit or installation personnel for the disposal by detonation or burning of unexploded ordnance that may be required under this contract. Disposal arrangements/agreements will be coordinated and established with the geographically responsible military EOD unit prior to the start of any field work under this contract. Disposal procedures will be accomplished in accordance with the 60 series EOD publications or approved installation open burning/open detonation procedures by military EOD or installation personnel. The UXO contractor may assist the military EOD or installation personnel in the performance of disposal as directed by the senior military EOD person onsite or by the installation commander or his designated representative. The military EOD or installation personnel are in charge of this operation and will not take taskings from the UXO contractor. Disposal arrangements under this contract will be approved by the USATHAMA Health and Safety Branch.

k. If open burning/open detonation operations cannot be conducted onsite, the UXO contractor will be responsible for coordinating and establishing arrangements/agreements for the packaging and transportation of unexploded ordnance and/ or explosive materiel to a location with approved government storage or to a location where open burning/open detonation is permitted. If military EOD assets are not available for transportation, the UXO contractor will be responsible for transportation. At a minimum, weatherproof, nonsparking containers will be utilized for packaging. Transportation of unexploded ordnance or explosive materiels, if required, will be accomplished in accordance witn all applicable Federal, state, local, and installation requirements, to include Department of the Army

l. The UXO contractor shall formulate, and implement an ordnance accountability procedure and have this documentation available for review.

m. The UXO contractor shall prepare and submit to the Government a final report covering all operations and activities conducted under this contract.

n. The UXO contractor personnel shall meet or exceed the qualifications requirements of Paragraph 3 below.

3. UXO Qualifications.

a. The UXO contractor shall provide a competent, UXO qualified project officer who shall be responsible for the overall management and the coordination of the location, identification, recovery/removal, and consolidation operations. The contractor UXO project officer will be responsible for the coordination and establishing of all necessary agreements with military EOD and/or installation personnel. The UXO contractor project officer shall have recent experience with projects similar to the contract project. Additionally, the UXO qualified project officer will have been a master rated EOD technician when on active duty.

b. The UXO contractor shall also provide a sufficient number of UXO qualified supervisors so that each work crew is assigned its own onsite UXO qualified supervisor. A UXO supervisor will not be assigned to a work crew of more than ten (10) non-UXO qualified support personnel. Additionally, UXO qualified supervisors will have been master or senior rated EOD technicians while on active duty.

c. UXO qualified personnel shall be graduates of the U.S. Naval School Explosives Ordnance Disposal (at a minimum phase I, chemical, and phase II, surface) and fully certified to perform EOD operations. UXO qualified personnel shall have four (4) years EOD experience in a military EOD operational position at the time of hiring. No more than three (3) years should have elapsed since the time of last UXO operational experience (military or civilian). UXO qualified personnel shall have knowledge and experience in military ordnance, ordnance component, and explosives location, identification, and render safe, recovery/removal, transportation, and disposal safety precautions. UXO personnel shall have the knowledge and experience to effect the safe handling, and transportation of found ordnance items. UXO personnel shall have extensive experience with the 60 series EOD publications.

d. UXO qualified personnel per Paragraph 3.c. above who have been relieved of EOD duties while on active duty or who

have revised their EOD volunteer statement while on active duty shall not be considered UXO qualified.

f. All onsite contractor UXO qualified workers shall be trained and experienced in accordance with the health and safety requirements for hazardous waste operations of 29 CFR 1910.120. UXO contractors and subcontractors shall also be required to comply with all other applicable Occupational Safety and Health Administration (OSHA) regulations.

g. The UXO contractor shall have sufficient UXO qualified personnel with current security clearances of appropriate levels so that these personnel may be granted access to 60 series EOD publications, if required.

h. Questions regarding UXO contractor UXO qualifications will be referred to the USATHAMA Health and Safety Branch. Personnel not meeting the above requirements are not considered UXO qualified and as such cannot perform or assist in the performance of identification, render safe or disposal procedures; however, they may be utilized for non-UXO procedures, i.e. surface sweep operations, *digging* operations, and geophysical detection techniques operations, under UXO qualified supervision. In some cases, former explosives test operators or explosives/munition handlers may be considered UXO qualified. This determination will be made by the USATHAMA Health and Safety Branch on a case-by-case basis.

4. Approvals and Certifications.

a. The UXO contractor shall provide written evidence of all permits, certifications, and approvals required by this statement prior to contract award.

b. The UXO contractor shall provide certificate(s) of insurance demonstrating that he has valid and current insurance coverage upon award of the contract. The UXO contractor must comply with provisions of the FAR regarding full insurance coverage. The insurance coverage must be appropriate for the hazardous and/or toxic nature of the work to be performed and it must cover all significant liabilities to include but not limited to death, injury, or property damage to the U.S. Army and its employees, the contractor and/or subcontractor employees, and members of the public (third-party claims).

c. The UXO contractor shall be responsible for complying with all existing and for obtaining any required additional permits, manifests, and approvals from Federal, state, local, and installation authorities. The UXO contractor shall also be responsible for ensuring that his work in all other respects complies with applicable federal, state, and local laws, regulations, and requirements.

7. Applicable Regulations.

The UXO contractor shall comply with the provisions of the following regulations:

a. DoD 6055.9-STD, Ammunition and Explosives Safety Standards;

b. AR 385-64, Ammunition and Explosives Safety Standards;

c. AR 50-6, Chemical Surety Program;

d. AR 75-15, Responsibilities and Procedures for Explosive Ordnance Disposal (EOD)

e. EM 385-1-1, Safety and Health Requirements Manual;

f. AMCR 385-100, Safety Manual;

g. AMCR 385-131, Safety Regulation for Chemical Agents H, HD, HT, GB, and VX; and

h. Applicable 60 series EOD publications.

This list is not all inclusive. The UXO contractor will comply with all other applicable laws, regulations, and requirements as stated in Paragraph 4.c. above.